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The Insistent Stability of Central Stations

REPORTS of central-station income and kilowatt-hour output, compiled by the ELECTRICAL WORLD in order to show the progress of the industry, are now available for the first four months of the European war period. The results published elsewhere in this issue are significant principally for their characteristic stability. Reduced rates of growth were inevitable. If any doubts existed about this, they disappeared when one domestic industry after another declined. Sooner or later general industrial conditions were certain to touch central stations. But it is decidedly encouraging, even to a buoyant industry, to find that growth continued in August, September and October, and that out of the four months from Aug. 1 to Nov. 30 only November showed a decrease in income over the corresponding month of last year, while that change was slight. November showed a slight gain in output. Optimistic expectancy looms large in the industry. Great increases have been made possible by new construction programs, seldom delayed. Where new business was, there lines were built in the confidence that dominates electrical operations. However, with curtailment in borrowing, central stations have not expanded physically on the generous scale of brighter times. New business has been secured mainly by intensive development. When investors again buy freely there will be fine potential markets for service.

Cultivating the Small Consumer

THE work accomplished by the Union Electric Light & Power Company of St. Louis in building up business is described in a current article. A specially vigorous effort was made to serve the small consumer at a profit. In two years the residence business has increased by more than 100 per cent, and in spite of the reduction of the rates the earnings have held their own. It was believed that increased business, including increased density of service, would bring its rewards even when the units of service were small. The minimum bill for residence lighting was cut from $1 to 50 cents per month, on the theory that while there would be some loss of revenue per customer, the volume of business would more than make up the loss—a theory verified by the facts. The immediate effect of the great increase of apparently petty business has been an improvement in the diversity-factor and a steady increase in the revenue. And it has been found that the increased use of electricity among the small consumers has more than offset the results of the decrease in motor service due to slack manufacturing. The company estimates that even though a consumer's bill is less than $1.50 a month he can be served with profit. Every satisfied customer is a friend, perchance a friend in need, and the more of such there are in the community the better.

The N. E. L. A. Accounting Section

THE proposed Accounting Section of the National Electric Light Association, which Mr. H. M. Edwards discusses in an interview in this issue, should be the medium for highly useful work for the central-station industry. Naturally its activities will be directed not solely toward general accounting matters but to a large extent in ways that reach public service commissions and hence the public. The accountant is the agency through which information required by commissions is mainly furnished. On his data rate-making is based. He can do much to develop public understanding of utility problems. The work of the accounting section, therefore, will supplement that of the public-policy and rate-research committees. Undoubtedly a section with its own committees will arouse a much greater following than that created by the single accounting committee of the past. The section will gather experiences with accounts, commissions, consumers and public that will be of immeasurable advantage.

Ice-Making in Massachusetts and Elsewhere

CONSIDERATIONS which led the Massachusetts commission to report against central-station ice-making are unquestionably influential, if not controlling, in that northern State, but they are partly local and are not applicable to other communities where different conditions prevail. The commission shows that manufactured ice in the State in 1913 amounted to only 3.5 per cent of the natural ice available, and this is eloquently expressive of the abundance provided by nature. In communities where temperature or other natural conditions do not provide the necessary ice, artificial ice-making is an economic need, and central stations can meet it at the lowest cost. It is one of the proved means by which the load-factor may be improved, and for that reason, even in a state where ice is as plentiful in winter as in Massachusetts, it holds an opportunity for central stations. Since there are legal obstacles in the way of Massachusetts companies and the commission has strengthened them still further by taking its stand, the next best step is to interest private capital in new undertakings which shall use central-station energy for this business at low rates with off-peak consumption.

Motor Service in a Printing Establishment

A brief article by Dr. A. C. Scott in the current issue gives the reader an excellent idea of the extent to which electrical power can be advantageously used in a printing office. One naturally thinks in this connection of motor-driven presses and some auxiliary machinery, but to the uninitiated the extent of the equipment required in the office of a live modern daily will be altogether a surprise. To begin with, the mere lighting of the offices, mechanical plant and storage rooms is a large item, 1400 tungsten lamps and ten mercury-arc lamps making the full equipment. When it comes to the motor outfit, the total runs up to nearly 400 hp. Of this the large items are, of course, the main press motors, which have a total rating of 225 hp. Nearly forty motors, mostly small, are utilized in the composing room and in the mechanical work pertaining to it, eight in the photo-engraving department, and so on, every important tool being motor-driven, to say nothing of the ventilating fans, elevators of various sorts and miscellaneous auxiliary machinery.

A very striking feature of the outfit is the wide variety of motors used, which is evidence of the extent to which motor-driven apparatus and tools have become regular stock articles sent out fitted for immediate operation and equipped with motors specially selected to meet requirements. No less than twelve makes of direct-current motors, large and small, are represented in this single plant, not counting the ordinary fan motors. We fancy it would be rather difficult to discover a more complete electric service in any newspaper office, large or small, than is here shown, and it furnishes abundant evidence of the value and importance of electric driving in an up-to-date printing establishment.

Export Trade.

The latest figures available as to export trade are those of the month of December, giving us also a calendar year. The data presented are interesting, but it is simply impossible to read into them any opinions or conclusions that are suggestive as to the better foreign markets supposed to be open for our goods in these extraordinary and unprecedented days. The assumption has been made with cheerful readiness that because neutral markets are deprived of material hitherto furnished from Europe our opportunity is practically limitless; but, if this be true, further statistics are needed to prove it. The evidence to hand shows that 1914 was the lowest in total values of three years, the figures being $23,212,813 for 1912, $28,197,363 for 1913, and $19,963,115 for 1914. There is, indeed, manifest here a sharp reversal, which is perhaps the more striking when contrasted with the statistics as to "explosives," these increasing from $5,525,077 in 1913 to not less than $10,037,587 in 1914.

It will be interesting to check up the figures of the current year, when any increasing export must soon be revealed. That neutral markets are open to us more than ever is an obvious fact, for there competition has been nullified if not killed; but it still remains to be proved that growth there can compensate us for losses in trade with the active combatants in the present terrific war. Month by month gains should be shown, for while the calls for new plants may be small, the necessity for supplies and renewals in existing plants and systems of any kind must be met. This should be more apparent now than it was in the last six months of 1914. It is an "open secret" that many electrical manufacturing concerns are doing quite a large business abroad, with a fair inference that to a notable extent this may be associated with warlike operations. That is an ill wind which blows no one good, but if there is any permanent and satisfactory business to be built up on the arts of war, destruction and general deviltry, we fail in appreciation of them. Meantime, looking at the figures for December, 1914, note may be made of the fact that the total value of all classes grouped as electrical machinery, appliances and instruments was only $1,620,563, as compared with $2,233,999 in December, 1913. That is certainly going backward, and what we expect is to go forward, to be accomplished possibly by "watchful waiting," if in no other way.

Sustained-Wave Radiotelegraph Receiver

Because of the drift toward extensive, if not exclusive, use of continuous waves in "wireless" telegraphy, Dr. Lee de Forest's article, on page 465 of this issue, will prove of more than passing interest. The audion has come to be recognized as an extremely sensitive responsive device for radio reception of grouped-wave telegraph signals, and its development to the point where it can also be used as a generator of radio-frequency alternating currents—and therefore as a self-contained receiver operating on the beat-tone principle—is of considerable importance. When, in addition to the normal rectifying-trigger action and the local-oscillating effect, there is involved the known amplifying power of this interesting vacuum-tube apparatus, it would seem that results may be secured which some years ago would have been considered nearly impossible.

The great problem of long-distance radiotelegraphy is to receive messages continuously in spite of severe "atmospheric" interference. Since the effect of such "static" or "X's" upon a receiving system is identical with the response produced by interception of a highly damped signal wave, and since "static" is bothersome at all normal working wave-lengths, it has come to be appreciated that this sort of interference can be reduced only by dependence upon tone quality and wave persistence as selecting means. In spark telegraphy this conclusion has been made use of by generating the signal waves in groups at definite high frequencies, such as would produce a clear musical tone at the receiver and thus permit aural distinction between messages and atmospherics. It has also been found that reduction of wave-damping factors at sender and receiver, involving the use of heavily loaded or "stiff" circuits at the intercepting station, makes possible a further reduction of "static" by the persistence-selecting method.

In carrying to the limit the reduction of damping, the practice of generating sustained or continuous waves has been largely extended. This transmission method, of course, gives opportunity for the utmost degree of static reduction by persistence selection. Nevertheless, in using the "tikker" receiver—which was the basis of sustained wave reception abroad and later in this country—it was not possible to differentiate between signals and "X's" by tonal effects. As Dr. de Forest points out, however, when incoming continuous wave currents are allowed to interact with locally generated alternating currents of slightly different frequency so as to produce audible beats, as in the "ultraudion," the highly useful aural discrimating means is effectively used. Interference from atmospheric and other damp-wave disturbances is therefore minimized in two ways, so that the astonishing delicacy of the audion may be turned to exceedingly useful application. As to practical uses, the instances of long-distance reception quoted in the present article would seem sufficient proof that the instrument has passed beyond the laboratory stage. The combination of local oscillator, "detector" and amplifier into a single apparatus appears to mark a definite step in the progress of radio signaling.

Inductive Interference

An important paper on interference between energy transmission and telephone and telegraph circuits was recently read by Mr. S. C. Bartholomew before the (British) Institution of Post Office Electrical Engineers. Troubles from inductive interference are relatively small in England, owing to the very general use of underground circuits and to the rarity of long high-tension overhead lines. Of course, now and then one encounters true leakage interference between neighboring systems, but this is on the whole rare and easily dealt with, so that the chief interest centers in the inductive disturbances, both electrostatic and electromagnetic. So far as ordinary three-phase systems are concerned, little trouble has been experienced in England, and with proper transposition of the lines the difficulties are really not serious. When a three-phase transmission line is spiraled thoroughly and carefully the residual voltages and currents are comparatively trivial, especially if the circuits interfered with are also spiraled as far as possible.

It should be remembered that the induction voltage produced by a short parallelism at close range may be rather severe and would not be improved by a long spiral on the interfering line. A telephone circuit which, for example, is not itself transposed and is run for even a few poles close to a heavy-current transmission circuit would be subjected to induction voltage from a line practically untransposed, since the parallelism would not cover a material portion of a spiral, and in such cases short transposition in the telephone line would be absolutely necessary. Similarly, parallelism with an energy-transmission circuit locally unbalanced is quite certain to produce trouble unless the telephone circuit is transposed throughout the whole length. In other words, to avoid trouble the two circuits must be arranged as far as possible with reference to each other's weak points, and if this be done, the interference from the ordinary overhead energy-transmission circuit can generally be reduced to a trivial amount. Both here and abroad the most serious difficulties are encountered in the case of railway working, particularly in a single-phase line. Leakage currents have produced more or less trouble from ordinary direct-current circuits, but the difficulty generally can be met without drastic remedies. In these days of well-made return circuits on railway lines and the general use of metallic circuits for telephones the matter is not at all a source of worry. However, direct-current railway circuits may produce, and do produce, inductive effects of a somewhat annoying character due to pulsations impressed on the direct-current circuit by the car motor or by the converter feeding energy to the line. In some English systems one or both of these sources of trouble have been considerably in evidence. In one case it was possible to detect the presence of the pulsating current from the converters 50 yd. from the track by aid of a search coil connected with the telephone.

Three remedies are feasible for this particular source of trouble, as Mr. Bartholomew shows. If the railway is equipped with a battery floating on the line, most or all of the pulsations will be absorbed. The larger ripples could be flattened out by a choking coil. A third method tried with promising results has been to connect condensers across the offending machine. On single-phase railways all kinds of trouble is encountered from the large currents involved. It may occur from earth currents or leakage, from electromagnetic induction from wires, rails and conducting cables, or from electrostatic induction from the trolley or other wires. Under ordinary circumstances the electromagnetic induction is the most prominent factor in the case. We have already described in these columns some of the ingenious remedies applied in the case of the New York, New Haven & Hartford Railroad which have been highly successful in overcoming the trouble. In general these have involved neutralizing the total resultant field due to the overhead wires by auto-transformers, and also applying compensating transformers to the circuits disturbed. Thorough working out of these remedial measures promises to relieve the problem of its grave features.

Mr. Bartholomew describes a very interesting "resonant shunt" method for freeing ordinary hand-worked telegraph circuits from induced disturbances. There is no complete generalized system of prevention which will apply under all circumstances to reduce inductive disturbances to a negligible amount, but experience seems to indicate that there are no cases which cannot be effectively met by symptomatic treatment of the difficulties which appear. Thorough transposition of one or both sets of wires at intervals dictated by the local opportunity for trouble comes perhaps as near to being a panacea as anything now in sight.

LETTERS TO THE EDITOR

The Unit of Brightness

To the Editor of the ELECTRICAL WORLD:

SIR:—I have read with much interest the letters from Mr. Cravath and Dr. Nutting on the unit of brightness. Mr. Cravath has pointed out the desirability of an additional unit which shall picture more easily to our mind's eye the connection between cause (illumination) and effect (brightness). The term he proposes—apparent illumination—does not seem to me desirable. Dr. Nutting now comes forward with an excellent name, if used appropriately, the "lambert." But he applies it, in my opinion, to the wrong unit. A little further along in this communication I wish to propose a merger of the best parts of both gentlemen's suggestions.

First, however, I wish to express my amazement at the list of the "necessary and sufficient" photometric quantities casually sprung upon us by Dr. Nutting without a word of explanation. On looking these over it will be found that he has simply taken the present quantities, as listed by the Illuminating Engineering Society, and the present names, has shuffled them and made a new deal! Thus what we all know as luminous flux (radiant power $\times$ luminous efficiency) figures in his list as "quantity." This is obviously wrong since power must be multiplied by time to give quantity, for example, the lumen-hour. Next, what we have all known as luminous intensity, namely, luminous flux per unit solid angle, here appears as "flux (lumens)." As a consequence of this general displacement of names with respect to quantities, the brightness unit is given as "lumens per unit projected area," in place of "candle-power per unit of projected area," although the quantity in question is exactly the same. It appears to me that this redistribution of names is quite uncalled for and sure to be productive of endless trouble. Certainly the fact should be emphasized that the "lumen" used in the final definition is not the present official unit. Unexplained, I am sure this point will cause confusion whenever Dr. Nutting's suggestion is quoted.

With this matter cleared up it is perhaps superfluous to point out that the proposal to call the unit of brightness the "lambert" does not have any direct bearing on Mr. Cravath's suggestion, for this "lambert" labors under exactly the same disadvantages as the candle-power per unit of projected area (solid angular flux density per unit projected area or lumens per unit solid angle per unit projected area), being, of course, the same thing.

The chief objection to Mr. Cravath's suggestion is, I think, in his term "apparent illumination," which does not tell enough. "Equivalent matte-white illumination" is nearer the term required but is too cumbersome. Now, an interesting thing is that Lambert's law has nothing whatever to do with the unit about which Dr. Nutting has written, but it is absolutely essential to Mr. Cravath's! Here comes my suggestion. Why not use the term "lambert" for Mr. Cravath's "apparent illumination"? In other words, let us say that a surface has a brightness of one "lambert" if it is as bright as a "Lambert's law" white surface under unit illumination. Put differently, the "lambert" would be $1 \div \pi$ candle-power per unit area.

HERBERT E. IVES,
Physical Laboratory,
United Gas Improvement Company.
Philadelphia, Pa.

Why Are Switchboards Elevated?

To the Editor of the ELECTRICAL WORLD:

SIR:—In my various travels I have noticed that in small generating stations the switchboards are often built in elevated positions so that one must climb a set of stairs in order to throw the switches, regulate the voltage and do the other little things about the switchboard that switchboards always need.

Not long ago, while visiting a Western plant I asked the engineer in charge why the switchboard was placed so high in the air. He replied that he didn't know and had never given any thought to the subject. He agreed with me that the switchboard would have been much handier if placed nearer the floor on which the rest of the equipment was installed, where there was an abundance of room. In answer to a similar question, another engineer stated that an elevated switchboard is less dangerous for visitors. And a third engineer told me that "that's the way switchboards are always built, judging from pictures, and so I suppose they built this one in the regulation way." "They look more electrical up high" was a fourth explanation. All of the engineers stated that it would have been best had the switchboards been erected on the operating floor. Verily, this is a comical world—sometimes.

New York, N. Y. N. G. NEAR.

Accounting for Depreciation

To the Editor of the ELECTRICAL WORLD:

SIR:—Mr. Cravath's methods of accounting for depreciation in what he terms the interests of a clear understanding on the part of examiners, as described in his contribution to the ELECTRICAL WORLD of Jan. 23, 1915, are subject to serious objections from both a theoretical accounting and a practical bookkeeping standpoint.

It is proposed that the balance sheet should show at any date: (a) The total first cost of all plant and property without deduction for depreciation; (b) the estimated total accrued depreciation irrespective of renewals made and paid for; (c) depreciation actually paid by the replacement and removal of certain parts.

Item (a), or the first cost of property, if this is understood to include only existing property, is usually represented by the account "property and plant" or "fixed capital," being the first item on the asset side of the balance sheet. No standard classification for public utilities provides that this account should be arbitrarily reduced by deductions for "estimated accrued depreciation," and reference to such a procedure is merely confusing. It is true that reference is made in certain English textbooks to such an accounting procedure for property "book values," but in the face of the objections that losses should not be deducted until they have been incurred, that the anticipated yearly share of such losses is not known, and that the resultant figure represents neither cost nor value, this theory has not received consideration in practical public utility accounting. The present standard ledger accounts will therefore disclose the information called for by item (a).

Items (b) and (c) are in fact a portion of the credits and charges to what is commonly known as the "depreciation reserve" or "accrued amortization of capital," and where such reserves are provided can with certain qualification be supplied by recapitulation by an accountant. It seems clear, however, that they have no place in the balance sheet.

There are certain elementary reasons, however, why such data will not be reliable. There are two ways of taking care of cost of replacing property or of reducing the property account when the property is abandoned and not replaced. One method is to take the loss when it is incurred or, if the amount be too large, to hold the

loss in suspense to be wiped out when the showing of the business will permit. The other method is to accrue a reserve to meet the loss when it occurs. No one can predict when the replacement loss will occur. The accountant can only accrue an arbitrary amount based upon the best information available to insure against such losses.

Since the company's policy as to how replacements are to be met and the lack of information as to when losses will ultimately occur are factors determining the size of the reserve, it is clearly misleading to expect it to represent the estimated accrued depreciation. Such balance-sheet figures merely indicate what provision the company has made to meet losses due to depreciation and must not be confused with the indeterminate quantity, theoretically representing expired values, labeled "accrued depreciation."

If item (c), deferred payments for replacements or renewals, represents only cash payments for replacements, it does not constitute all of the proper charges against the depreciation reserve. Where property is abandoned and not replaced a credit to the property account must be offset by a charge to the depreciation reserve. In this way the depreciation liability is directly liquidated without a cash transaction. What is "paid out" for replacements does not represent the amount by which depreciation is "made good."

Under "simple methods of accounting," one of the bookkeeping procedures suggested is the raising of a ledger account "depreciation paid," which is to be "charged and cash credited with all expenditures on renewals and replacements." Since some time must necessarily elapse between the date when the old property is abandoned and its substitute constructed and paid for, the bookkeeper will be hard pressed to dispose of charges and credits in the intervening period.

An alternative method is proposed of setting up two general ledger accounts, one representing "depreciation accrued" and the other "depreciation payable," the entries of which under an ordinary double-entry system are explained to consist of a debit to "depreciation accrued" and a corresponding credit to "depreciation payable." If "depreciation accrued" is debited, its accumulation will occur on the asset side of the balance sheet if it is a balance-sheet account, as the succeeding discussion seems to indicate, and not a profit and loss account, while "depreciation payable" will correspondingly appear on the liability side. Yet in succeeding paragraphs "depreciation accrued" is referred to as a liability and "depreciation paid" as an asset, although preference is expressed in the same paragraph for the set-up of "depreciation paid" as a liability because it involves no irregularities in making up the balance sheet.

"Replacements and renewals are to be cared for either by a charge to 'depreciation payable' and a credit to cash with objections similar to the first method, or plant account is to be charged with the entire cost of renewal and cash account is to be debited" (credited?). At the same time the property account is to be credited with the real or estimated cost of the apparatus replaced and depreciation payable is to be charged.

Referring to the placing of these accounts in the balance sheet, it is stated: "In annual or monthly statements and balance sheets accrued depreciation can be entered as a liability with paid depreciation as a partially offsetting asset, in which case the accrued depreciation will not appear on the ledger account but only on the balance sheet." Proper accounting methods do not permit the entering at will of items on the balance sheet that do not appear on the ledger.

There is serious doubt as to the simplicity of a scheme of augmenting the "depreciation accrued" account by an account labeled "depreciation payable." The latter account is not analogous to notes payable or accounts payable as stated. Notes and accounts payable are current liabilities, while "depreciation payable" as it is defined represents the earnings reserved to care for replacement and is a contingent liability. It is obvious that no concern will view favorably the suggestion to classify its reserve as a current liability in the statement upon which it negotiates a bank loan or makes application for credit rating.

Such descriptions of accounting methods serve to shroud the depreciation "problem" in mystery. Much has been accomplished within the past few years by the technical associations and by regulating commissions in prescribing accounts to define the principles and procedure by which these transactions may be handled. Such methods have become standardized, and it is suggested that they are entitled to the same consideration which is accorded to engineering standards. Under the standard procedure it is possible from a single depreciation reserve account to ascertain the information which Mr. Cravath has outlined, although it is not clear just what useful purpose such information may serve. If mortality data be desired, there are more direct means of gathering the same.

New York, N. Y. ROBT. SEALY.

Approval of Refillable Fuse

To the Editor of the ELECTRICAL WORLD:

SIR:—Answering your inquiry in reference to the accuracy of the article published by you in your issue dated Dec. 26, 1914, announcing the approval by us of the Star renewable fuse, we beg to state that we believe you were very naturally led into error by a copy of a preliminary report issued to the manufacturer by this office, officially signed, and indicating favorable action on some of the Star fuse products. That no official record was later promulgated bearing out these statements in all respects is due to the fact that approval of the council of Underwriters' Laboratories, which is necessary before promulgations are made, was not secured. The safe guide in all these matters is the official promulgations made semi-annually in the list of electrical fittings and by means of the cards of approval, which are issued from week to week. As you receive both the lists and the cards regularly, it would seem that these should be the basis of your articles or reports on the business of these laboratories. W. H. MERRILL,

Chicago, Ill. *Manager Underwriters' Laboratories.*

[We think it due our readers to print the above statement from Mr. Merrill. As will be noted from his letter, the preliminary report indicating approval of the device, which was sent by the Underwriters' Laboratories to the members of the Laboratories council and to the manufacturer of the device, was an official document. It was dated Dec. 1, 1914, and signed by both the manager and the electrical engineer of the Laboratories. Obviously, this would indicate official approval. Moreover, as a result of an inquiry from a prospective user of the Star fuses a letter was written from the Laboratories on Nov. 17, 1914, stating that "approval card is now being issued on the 6, 10, 15, 20, 45 and 60-amp sizes, but not including the 30-amp size." Being convinced that the above report and letter had in fact been sent out by the Laboratories, with appropriate journalistic enterprise the ELECTRICAL WORLD gave publicity to the fact that a refillable fuse of the cartridge type had been approved by the Underwriters. Meanwhile, however, the council of the Underwriters' Laboratories requested that promulgation of the approval cards be stopped and asked for fur her information and tests.—ED.]

The Motor-Driven Plant of the "Dallas News"

Description of a Newspaper Installation in the Southwest the Unusually Complete Equipment of Which Is Operated by Electricity

BY A. C. SCOTT

THE most complete newspaper plant in the Southwest, one with no superior in the country for the expeditious handling of business and the convenience and comfort of employees, is that of the *Dallas News*, which, being an offspring of the *Galveston News*, established in 1842, is the oldest newspaper published in Texas.

The recently completed building occupies the space of an entire half block. The smaller building contains paper-storage rooms in the basement, the business and circulation offices on the first floor, the editorial and art rooms, library, ladies' rest room, etc., on the second floor, while the third floor contains the telegraph department, engraving department and reportorial department.

The basement of the printing plant contains the boiler and engine rooms and a large paper-storage room. The latter, together with the rooms in the basement of the smaller building, accommodates about thirty carloads of paper. The first floor contains the press room and city distribution room; the second floor contains the mailing room and the job department, and the third floor accommodates the composing and stereotyping rooms.

The ceilings are extra high in the new building, particularly in the basement and top story. There are nineteen different floor levels in the building, made necessary to accommodate all the machinery in use in the most modern and economically convenient manner. The entire building is of modern fireproof construction and is equipped with a vacuum cleaning system, an automatic sprinkler system and passenger and freight elevators.

It is naturally lighted and ventilated to the fullest extent. It is artificially lighted with tungsten lamps throughout, supplemented in the press room with ten mercury-arc lamps. The various departments have a total equipment for artificial ventilation of eleven large exhaust fans, forty-five ceiling fans and thirty-five desk or bracket fans. In addition to these the engine room is supplied with fresh air by a 30-in. Sirocco motor-driven fan, and the boiler room is equipped with one 42-in. and one 24-in. exhaust fan. The building is heated throughout by the Webster vacuum system of steam heating.

In the composing department on the third floor twenty-two linotype machines are kept busy. Each of these machines is driven by an electric motor, and heat is furnished for the type metal by natural gas. In this department are also motor-driven proof-presses, a metal saw and an emery wheel. The arrangement of the equipment is such that work is facilitated to the utmost. The stereotyping department, which is on the same floor in a large room adjoining the composing room, is equipped with the latest Hoe stereotyping apparatus, including two matrix rolling machines, a four-section compressed-air steam table, a melting pot and other machinery for flat casting; also with flat and curved routers and a double junior autoplate machine and autoshaver having a maximum output of six plates per minute finished completely.

The second floor houses the job department and the mailing room. No commercial job work is done. The mailing department in the rear is over an alleyway, and chutes for mail sacks and packages send papers down ready for placing in wagons, which drive up in the alleyway and turn around in a large open court in the rear between the two buildings. There are four chutes in this alleyway.

On the first floor of the new building are the press room and the city distribution room. In the press room are two of the latest-type Goss sextuple presses, one Hoe sextuple press and one Walter Scott quadruple press. Each of the two Goss presses has a rated output of 72,000 twelve-page papers per hour; the Hoe press has an output of 48,000, and the Scott press an output of 24,000 per hour. All of the presses are motor-driven, and three of them are equipped with Kohler control. In front of each of the presses is mounted a vertical paper conveyor for delivering the papers to the mailing room on the floor above, and also

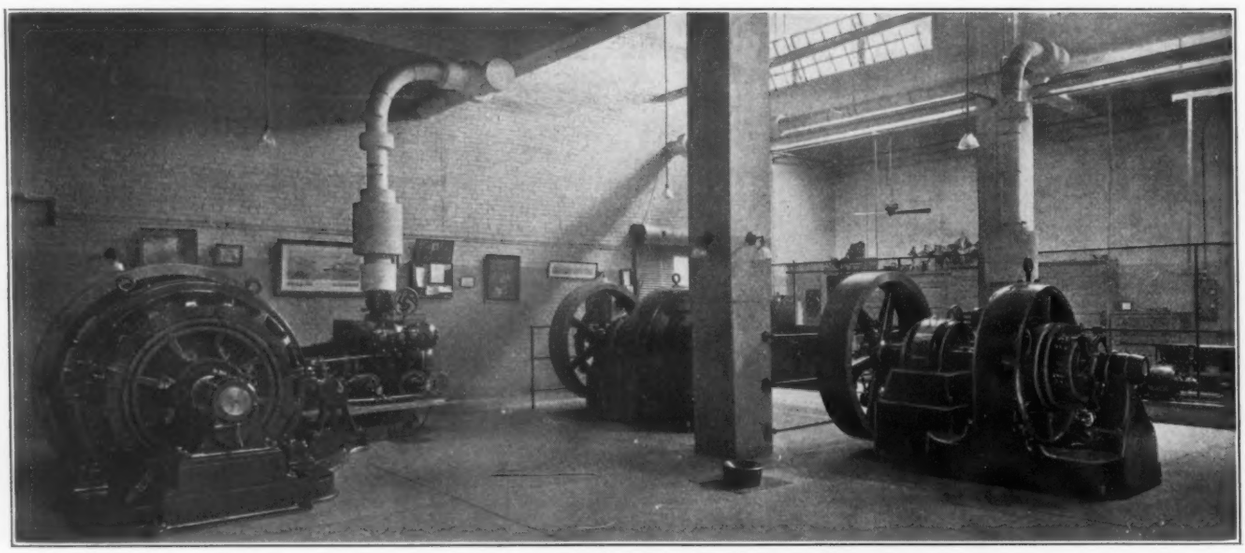


FIG. 1—ELECTRICAL GENERATING EQUIPMENT IN "DALLAS NEWS" PLANT

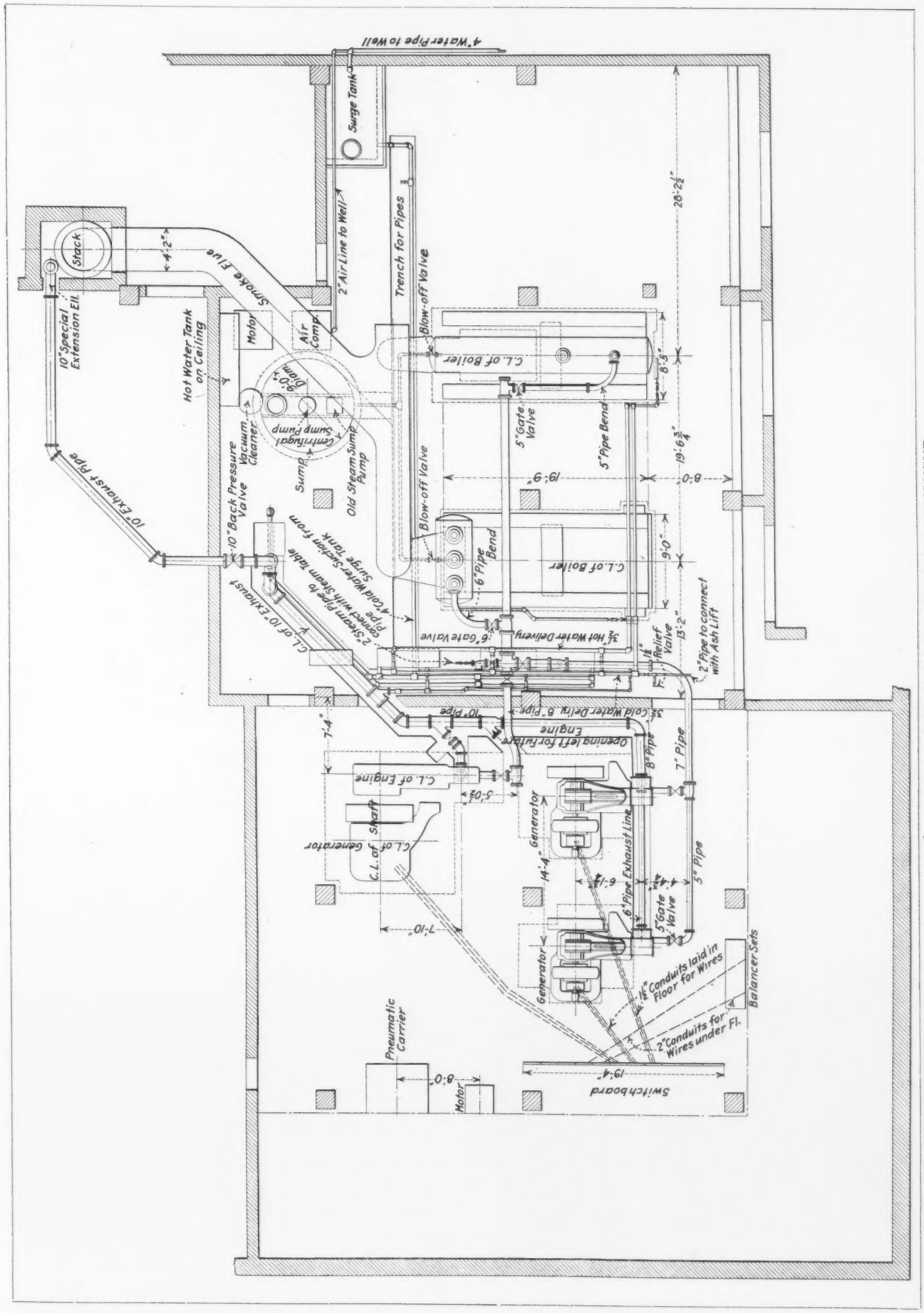


FIG. 2—DIAGRAM OF GENERATING AND BOILER EQUIPMENT

FIG. 3—LINOTYPES OPERATED BY INDIVIDUAL MOTORS

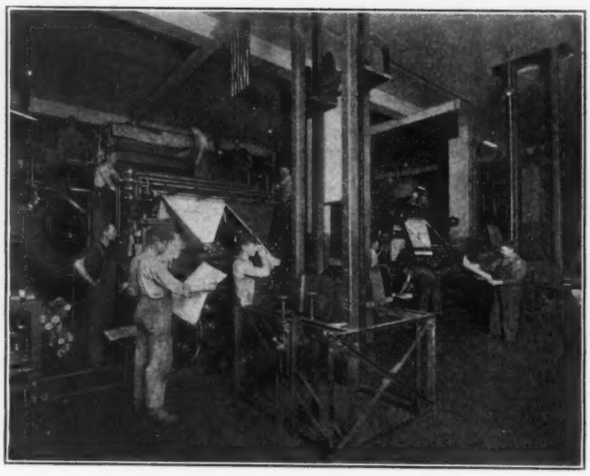


FIG. 4—MOTOR-DRIVEN PRESSES

one horizontal conveyor for delivering papers to the city circulation department.

The basement is used exclusively for paper storage and the generating equipment. The paper-storage rooms are equipped with two sidewalk elevators for receiving paper, and the main storage room is provided with trolley track and hoists for moving the large rolls of paper from place to place and delivering them to the presses immediately above. All presses are supported on steel beams, an arrangement that allows free headroom in the paper storage underneath them.

The power-plant equipment was designed to provide all of the electric service required by the *News* entirely independent of any outside source. It is stated that during the past twenty-five years no issue of the *News* has failed to come out on time, and it has been the aim of the engineers to safeguard the future in that respect by the installation of the proper equipment in the new plant.

The boiler room is equipped with two Babcock & Wilcox water-tube boilers, having capacities of 200 and 150 nominal horse-power respectively. Use is made of natural gas as fuel, but ample provision is also made for the use of coal in case of the failure of gas, and an electric sidewalk elevator is provided for hoisting the ashes. Water is obtained from a deep well owned by the *News*. The water is forced into a surge tank by a motor-driven air-compressor, and thence delivered to house tanks on the roof of the building for all purposes, by any one of three duplex pumps which are so con-

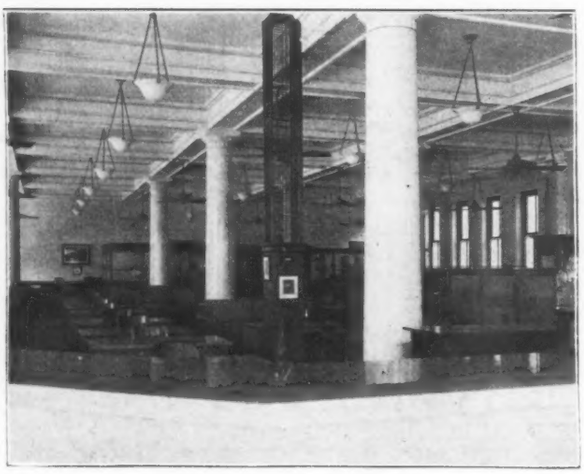


FIG. 5—BUSINESS OFFICE OF THE "DALLAS NEWS"

MOTOR-DRIVEN AND LIGHTING EQUIPMENT OF "DALLAS NEWS"

Machine	Motor Hp	Make
Basement:		
Air compressor	15.0	Westinghouse
Tuec vacuum cleaner	5.0	United Electric Co.
Ash lift	5.0	American
Paper lift	5.0	American
Sump pump	2.5	Imperial Electric Co.
Shop	2.0	Sprague
Sirocco fan	1.5	Westinghouse
Exhauster (42-in.)	1.0	Westinghouse
Exhauster (24-in.)	0.5	
Paper lift	10.0	Sprague
Freight elevator	7.5	American
First floor:		
Goss press motors (one 60-hp, one 10-hp)	70.0	Westinghouse
Goss press motors (one 60-hp, one 5-hp)	65.0	Westinghouse
Paper hoist	1.0	Sprague
Paper hoist	1.0	Sprague
Hoe press motors (one 40-hp, one 10-hp)	50.0	Sprague
Paper hoist	1.0	Sprague
Scott press motor	40.0	Sprague
Paper hoist	1.0	Sprague
Second floor:		
Four paper hoists to mailing room	12.0	Crocker-Wheeler
Second floor—job department:		
Two job presses	0.5	Westinghouse
Paper cutter	2.0	
Wood saw	1.5	Robbins & Myers
Folding machine	0.125	General Electric
Multigraph machine	0.125	General Electric
Copy elevator	0.125	Westinghouse
Second floor, photo-engraving department:		
Beveler	0.25	Sprague
Emery wheel	0.125	Westinghouse
Wood planer	2.0	Sprague
Metal saw and trimmer	2.0	Sprague
Jig-saw and boring machine	0.5	Sprague
Flat router	1.0	Sprague
Etching machine	0.5	Emerson
Etching tub	0.25	Sprague
Third floor:		
Autoplate (double)	15.0	Jenney
Autoshaver	3.0	Sprague
Plate trimmer	3.0	Sprague
Plate shaver	3.0	Sprague
Air-compressor for steam table	6.8	Westinghouse
Matrix rolling machine, No. 1	3.0	Sprague
Matrix rolling machine, No. 2	3.0	Sprague
Curved router	1.0	General Electric
Flat router	1.0	Sprague
Flat planer	3.0	Sprague
Saw and trimmer, No. 1	3.0	Sprague
Saw and trimmer, No. 2	2.0	Sprague
Emery wheel	0.125	Westinghouse
Proof press, No. 1	0.25	Emerson
Proof press, No. 2	0.25	Sprague
Metal saw	0.5	Northwestern
Twenty-two linotype machines, 0.25 hp each	5.5	General Electric
Passenger elevator	30.0	American Machine Co.
Total	390.425	
General:		
Two 36-in. exhaust fans	.....	.....
Six 24-in. exhaust fans	.....	.....
Two 3[illegible]-in. exhaust fans	.....	.....
One 18-in. exhaust fan	.....	.....
Forty-five ceiling fans	.....	.....
Thirty-five buzz fans	.....	.....
Ten mercury-arc lamps	.....	.....
1400 tungsten lamps	.....	.....

nected as to be used for pumping either hot or cold water. A 250-hp Cochrane feed-water heater is used in the plant with connections to receive the exhaust from all engines and pumps. All exhaust-steam lines are laid in waterproofed trenches underneath the concrete floor, which are covered with iron plates and extended to a sump. From the sump all waste water from engines, pumps and boiler blow-offs is elevated to the storm sewer by means of a vertical motor-driven automatically controlled turbine pump. The sump is also provided with a steam pump for emergency service.

The motive-power equipment consists of one Harrisburg-Fleming four-valve engine directly connected to a 150-kw, 220-volt Westinghouse direct-current generator, and two American Ball 75-kw, 220-volt units. The switchboard contains three generator panels, two balancer panels and six feeder panels. Use is made of two Westinghouse balancer sets, one of 70-amp and one of 30-amp rating. A motor-driven ringer set is in constant use for the service required in the composing room on the linotype machines.

The motor-driven equipment and lighting equipment of the plant as a whole are shown in condensed form in the table accompanying this article.

The building recently completed was designed by Hubbell & Greene, architects, Dallas, Tex. The power-plant equipment was planned by the Scott Engineering Company, Dallas.

The Ultraudion Detector for Undamped Waves

Modification of the Audion Which Makes of It an Extraordinarily Sensitive Instrument for This Purpose and Offers Great Possibilities for High-Speed Wireless Records

BY LEE DE FOREST

WHILE the users of the "audion" detector are now numbered by the hundreds, very few perhaps understand that by slight modification of circuits, or with certain bulbs by mere adjustment of the filament-heating current and B battery potential, it becomes a detector of undamped wave signals, of an extraordinary sensitiveness.

The audion under the above-described conditions becomes a persistent oscillator or generator of continuous oscillations of absolutely constant amplitude. The power thus generated varies from the order of a microwatt in the usual small audion bulb to tens of watts in bulbs 3 in. in diameter or larger, consuming 2-amp or 3-amp filament current, and energized by a B potential of several hundred volts.

To an audion detector bulb in this oscillating condition the name "ultraudion" has been applied, as fitly descriptive of the ultra sensitive response which it then gives to incoming received oscillations. Whether these be of undamped or damped characteristics, the sensitiveness of the ordinary audion (itself generally admitted to be by far the most sensitive wireless detector yet known) is greatly enhanced—from tenfold to fifty-fold—according to the quality of the individual bulb and of the particular circuit combination of which utilization is made.

Discovery of the Principle

The ultraudion state was first discovered by the writer when using a bulb connected in the usual manner, with a well-designed secondary receiver circuit connected across the grid and filament (standard audion connection). The filament was heated to an unusual degree, thereby reducing the internal resistance of the bulb, and the capacity of the "stopping" condenser in series with the grid made extremely small, of the order of 0.0001 mf. While testing this bulb with an arc transmitter station I observed that, at a certain adjustment of the filament current and B battery, the customary rough hissing sound due to the irregularities of the arc was suddenly replaced by a faint flute-like whistle. The pitch of this note could be varied at will by varying the capacity of the condenser in shunt to the secondary of the receiver transformer.

It was at once apparent that here was a tiny generator of undamped oscillations the period of which could be controlled within limits by varying the constants of the closed oscillating circuit, and to a certain degree by the heating current and B potential.

At a later date, when developing the audion amplifier as a relay for telephone currents and weak wireless signals, I found that with two bulbs connected in cascade this ultraudion condition could be more readily produced, owing to the tendency of the impulses set up in the second audion to react upon the first, through the coupling transformer or associated circuits.

In fact, the low or audio-frequency oscillations thus set up often became a nuisance until special care was taken to neutralize this reactive tendency. Loud siren notes, of pure quality and piercing intensity, were readily obtainable, the pitch of which could be altered in droll effects merely by touching one or another point of the associated circuits with the finger.

When means were provided for conducting high-frequency oscillations from the first to the second audion circuit—as, for example, by shunting the heavy retardation-coil B batteries and telephone receivers by small condensers—and the first audion and its shunted oscillating circuit were caused to set up high-frequency oscillations, these were amplified in the second audion radio circuits, provided the latter were attuned, or nearly in tune, with those of the first audion or with their lower harmonics.

The action of the second audion is almost invariably to amplify the impressed high-frequency currents, so that in a telephone receiver connected in the usual fashion between the plate and the B battery of the second audion one hears a beat-note of surprising intensity. The pitch of this note can be run through the entire gamut of audibility from upper audibility down to a low guttural note, then lapsing into inaudibility as the two oscillating circuits are brought into nearly exact resonance, then rising higher and higher as one or the other circuit is again detuned.

The power represented in this beat-note is many hundred times that of the initial high-frequency power in either oscillating circuit alone.

Various Functions of the Instrument

Therein lies the principle of the extraordinary sensitiveness of the ultraudion detector of undamped oscillations. It becomes at once a source of continuous oscillations, a detector of the incoming oscillations, and an amplifier either of these latter in their original fre-

quency or of the beat frequency set up by the interference between these two radio-frequency oscillations of slightly differing periodicities.

In the form of ultraudion circuit most preferred all of these functions are performed in one bulb and one oscillating circuit with a small condenser of variable capacity in shunt around the B battery and telephone re-

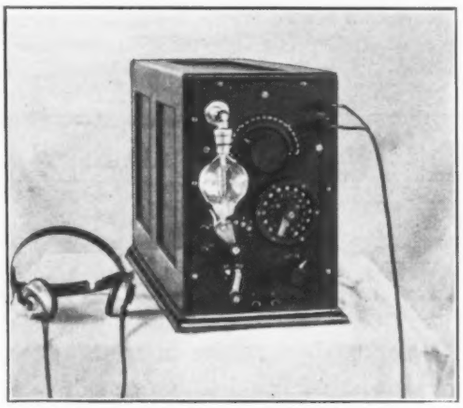


FIG. 1—12-VOLT ULTRAUDION DETECTOR

ceivers. The ultraudion bulb itself is preferably of different construction from the ordinary detector audion, being supplied with double plate and grid elements. However, the ultraudion effect can be obtained in many single bulbs, particularly if of high vacuum.

The B potential must, however, not be made too large, for it is easy to send the bulb back into the non-oscillating condition. One can easily determine when a bulb is in this ultraudion state by touching one terminal of the oscillating circuit with the finger. A characteristic "cluck" or scratching sound is then heard in the telephone receiver which is entirely absent when the bulb is not oscillating.

When used as a detector of damped-wave signals, the true spark-tone quality is entirely absent, unless these signals are extremely intense. The sound of spark signals takes on instead a hissing, rustling or unclear quality, very similar to that from a rotary "tikker" as used with the Poulsen system.

Thanks to the greatly enhanced sensitiveness of the ultraudion, these spark signals are now many times as loud as when the simple audion reproduces the true tone quality, a fact which ordinarily gives the ultraudion a very real advantage even for spark reception. Moreover, an increased immunity from interference from more strongly damped spark stations is afforded. In times of severe static disturbances, however, the advantage of the high, clear spark notes and the individuality of the tone quality of a sending station more than compensates for the reduced audibility factor of the simple audion.

As detectors for undamped oscillations, there are available to-day four types, the Poulsen "tikker," the Goldschmidt "tone wheel," the Fessenden "hetrodyne" and the "ultraudion."

The latter combines at once points of simplicity, reliability, sensitiveness, sharpness of tuning and tonal selectivity, which, I believe it can be stated without fear of dispute, mark it as unique in the field of present-day wireless detectors.

For many months at the United States naval radio station at Arlington, Va., use has been made of the ultraudion in daily reception of messages from the 50-kw arc station at Honolulu, H. I. At the Washington Bureau of Standards daylight signals are also received from Eilvese, Germany, with several hundred times audibility, using an aerial 150 ft. in height. In New York messages from the undamped-wave stations at Nauen, Germany, and San Francisco are picked up at almost any hour of the day during the fall and winter on an antenna lying below the level of the highlands on either side of the Harlem River, and always without the slightest interference from any of the powerful stations from New York to Tuckerton, N. J., and Arlington, Va.

When receiving from arc station—for example, Newcastle, New Brunswick or San Francisco—both the sending and compensation waves can be heard if desired, as two clear, flute-like tones, one differing by about a half octave from the other, alternatively as the transmitting key lengthens or shortens the emitted wave. If, however, it is desired to silence completely the compensation "signal," it is necessary merely to attune the period of the receiver circuit to close syntony with the compensation wave-length, when the local circuit is forced into syntonic oscillation therewith, and that beat-note disappears. This leaves the signal wave to form a solitary low-pitch beat-note with the ultraudion's local oscillation.

High-Speed Wireless Recording

For high-speed recording of wireless signals the ultraudion offers great possibilities. In the rapid transmitting and automatic recording system which the writer developed for the Federal Telegraph System between San Francisco and Los Angeles, the "tikker" signals were first amplified by a three-step audion amplifier and then recorded upon the rapidly traveling steel wire of an American telegraphone. This record was subsequently run off again at a speed one-third to one-fifth that of the original recording speed and the message thereby rendered readable by ear. In this manner wireless messages, tape-punched, have been transmitted commercially at a speed of from 60 to 100 words per minute.

The method has proved itself a genuinely practical one. The speed limit imposed, however, was found to be that due to the quality of the "tikker" signals itself. When these signals were reproduced at a speed for ear reading which was less than that above mentioned their low non-musical quality caused the "dots" to become quite inaudible.

With the ultraudion detector, however, the pitch of

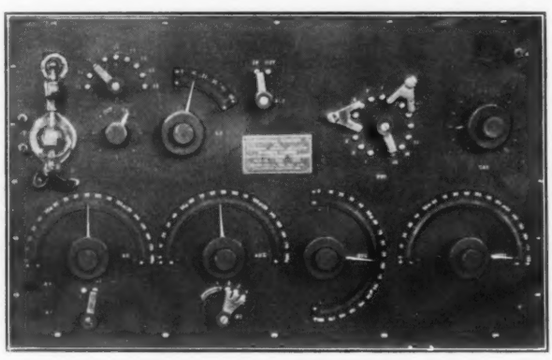


FIG. 2—ULTRAUDION DETECTOR FURNISHED TO UNITED STATES NAVY

the received signals can be made as high as the telephone diaphragm or the magnetic lag of the telegraphone wire will permit—say, 6000 per second. This plan permits a reproduction speed of one-twelfth, with a good readable note of 500 per second, at a speed, say, of twenty-five words per minute for a speed of transmission of 300 words per minute.

CENSUS REPORT ON CAPITALIZATION

Great Increase in Total Costs of Construction and Equipment for Central Electric Stations

More statistics relating to capitalization of central electric stations are given in the 1912 census than in previous censuses. In the earlier censuses these statistics were confined to the stock and bonds of commercial corporations, the bonds of municipalities issued to secure funds for construction, purchase or operation of municipal stations, and the returns made on such capitalization. In the last census a balance sheet as of Dec. 31, 1912, was secured from both commercial and municipal stations. The capitalization as stated for 1912, therefore, includes for commercial companies, in addition to stock and funded debt, the cash investments, real-estate mortgages and floating debt. The balance sheet for municipal central stations shows $31,189,357 funded debt and $27,064,963 cash investments, a total of $58,254,320. Since no cognizance was taken of indebtedness which had been liquidated, the census report does not regard this total as representing fairly the capitalization of these stations. The capitalization used is the amount reported for the cost of construction and equipment.

TABLE I—CAPITALIZATION OF CENTRAL ELECTRIC STATIONS, 1912

Total	$2,289,622,199
Commercial stations	$2,212,557,055
Capital stock	$1,154,587,016
Common stock	977,639,057
Preferred stock	176,947,959
Funded debt	897,907,681
Cash investments	12,165,075
Real estate mortgages	10,170,898
Floating debt	137,726,385
Total	$2,212,557,055
Deduct intercompany holdings and treasury securities	126,305,618
Net capital	$2,086,251,437
Deduct investments outside of electric light and power industry	76,721,716
Net capital based on commercial electric light and power industry	$2,009,529,721
Municipal stations:	
Cost of construction and equipment	$77,065,144

Table I shows the total capitalization of central electric stations, divided between commercial and municipal plants, and also the net capital based on the returns of commercial stations. Commercial stations had 96.6 per cent of the total capitalization and municipal stations 3.4 per cent. Capital stock represented 50.4 per cent of the total capitalization. Of the entire stock 84.7 per cent was common and 15.3 per cent preferred. Funded debt aggregated 39.3 per cent of the total capitalization, floating debt 6 per cent, cash investments 0.5 per cent, and real-estate mortgages 0.4 per cent. In the calculation of the net capital of commercial central stations, the census report shows a deduction of $76,721,716 investments outside of the electric light and power industry. Of this $65,895,784 represents stock and bonds in companies other than electric and $10,825,932 is other permanent investments.

Capitalization statistics are compared in Table II. As municipal returns were unsatisfactory, the data are confined to commercial stations. Commercial central-station capitalization increased from 1902 to 1907 113.9 per cent and from 1907 to 1912 52.9 per cent. Funded debt increased from 1902 to 1907 136 per cent and from 1907 to 1912 49.5 per cent. Capital stock increased from 1902 to 1907 98.8 per cent and from 1907 to 1912 55.7 per cent. The percentage of increase in preferred stock was very much greater than in common stock. Preferred stock gained from 1902 to 1907 215.5 per cent as compared with 90.8 per cent for common, and from 1907 to 1912 preferred stock gained 134.9 per cent as compared with 46.8 per cent for common. The relative proportion of bonds and stock showed comparatively slight changes from 1907 to 1912. In 1912 stock capitalization represented 56.3 per cent of the total capitalization, in 1907 55.2 per cent, and in 1902 59.4 per cent. Funded debt represented in the same years respectively 43.7 per cent, 44.8 per cent and 40.6 per cent.

The Bureau of the Census directs attention to the fact that its statistics for capitalization should not be used as a basis for computation of the return on investments. Many companies operate other industries in connection with central stations and do not segregate their data pertaining to investments, income and expenses for each branch. The incomplete returns, however, show that in 1912 the 2663 commercial companies paid 2.9 per cent dividends on common stock as compared with 2.5 per cent in 1907 and 1.6 per cent in 1902. Preferred dividends were: in 1912, 3.4 per cent; in 1907, 3.2 per cent, and in 1902, 2.6 per cent.

The 1902 census schedule called for a separate statement of costs during the year and to date under the following heads: Land; buildings; machinery, tools and implements within stations; overhead electric service construction; underground electric service construction; lamps, motors, meters and transformers, wired for use; supplies of every description on hand; miscellaneous equipment. A majority of the companies contended that it was impossible to report the cost in the detail requested, and many asserted that they had no data from which even total cost to date could be estimated with a fair degree of accuracy. Therefore the attempt to ascertain cost in detail was abandoned in 1907, but in an effort to preserve comparative statistics the total cost of plant and equipment and the cost of construction during the census year were requested. Even this modification was unsatisfactory, and in 1912 the form was simplified still further and only the total cost of construction, equipment and real estate was requested. The cost of construction and equipment for the country as a whole increased from $504,740,352 in 1902 to $1,096,913,622 in 1907, or a gain of 117.3 per cent. There was a further gain to $2,175,678,266 in 1912, or 98.4 per cent over the 1907 figure. From 1902 to 1912 the increase was 331 per cent. The greatest percentage of increase in the decade in any of the geographic divisions followed in the census report was in the Pacific States, which gained 763.6 per cent. The census grouping of states was stated in detail in the ELECTRICAL WORLD of Jan. 16, 1915, page 161. The Mountain States were slightly lower, with a gain in ten years of 758.7 per cent.

TABLE II—COMMERCIAL COMPANIES—CAPITAL STOCK, FUNDED DEBT, AND DIVIDENDS

	1912	1907	1902	Per Cent of Increase 1907–1912	Per Cent of Increase 1902–1907
Commercial companies having outstanding capitalization	*2,663	†2,516	2,049	5.8	22.8
Total capitalization outstanding	$2,052,494,697	$1,341,995,182	$627,515,875	52.9	113.9
Capital stock	$1,154,587,016	$741,317,497	$372,951,952	55.7	98.8
Common stock	977,639,057	666,003,772	349,080,281	46.8	90.8
Preferred stock	176,947,959	75,313,725	23,871,671	134.9	215.5
Dividends	34,580,872	19,300,572	6,189,837	79.2	211.8
Dividends on common	28,602,399	16,883,812	5,560,341	69.4	203.6
Dividends on preferred	5,978,473	2,416,760	629,496	147.4	283.9
Funded debt	897,907,681	600,677,685	254,563,923	49.5	136.0

*Exclusive of capitalization of 169 electric-railway light and power departments and 116 central electric stations not reporting stock and bonds, but including eighteen stations whose capitalization was reported by other stations and twenty-three stations reporting bonds only.

†Exclusive of thirty-seven companies but including two companies reporting bonds only, their capital stock not being separable from that representing other interests.

The East South Central States gained 725.5 per cent, while the South Atlantic States showed 590.1 per cent. The Middle Atlantic States gained from $211,010,618 in 1902 to $391,858,983 in 1907, or 85.7 per cent, and reached the large total of $584,107,361 in 1912, or 49.1 per cent more than in 1907.

The largest percentage increase shown by any state was that of Nevada, 4205.5 per cent. Idaho had 4037.7 per cent and Oklahoma 2134.7 per cent. The states which showed the largest total cost of construction and equipment in 1912 and the percentage of increase in that year as compared with 1902 were: New York, $350,526,904, or 210.2 per cent; California, $344,389,232, or 842.3 per cent; Pennsylvania, $164,522,076, or 295.7 per cent; Illinois, $162,104,226, or 322.9 per cent; Michigan, $72,764,830, or 529.5 per cent; Massachusetts, $71,707,238, or 142.6 per cent. States which showed gains in the decade of over 1000 per cent in cost of construction and equipment, in addition to Nevada, Idaho and Oklahoma, were South Dakota, with 1715.2 per cent; Georgia, 1488 per cent; North Carolina, 1403.9 per cent; South Carolina, 1292.2 per cent; Montana, 1262.3 per cent; Kansas, 1185.8 per cent; West Virginia, 1091.9 per cent; North Dakota, 1071.1 per cent; Tennessee, 1052.3 per cent, and Arizona, 1042.5 per cent.

Table III shows total costs divided between commercial and municipal stations, the average cost of construction per kilowatt rating of dynamos and per horse-power of primary power machines for the three census periods. The average cost per station in 1912 was $416,717 as compared with $232,693 in 1907 and $139,431 in 1902. The averages for commercial stations for the same years were, respectively, $573,548, $304,458 and $172,093. For municipal stations the corresponding figures were $49,337, $34,249 and $27,019. The average cost of construction per kilowatt rating of dynamos for all stations decreased from $416 in 1902 to $405 in 1907, but increased to $424 for 1912. Similarly the average cost of construction per horse-power of prime movers went from $274 in 1902 to $268 in 1907 and $289 in 1912.

The attempt made in 1907 to secure separate income data for arc and for incandescent lighting, stationary motor service, charging automobiles, electric heating, cooking, welding, etc., was abandoned in 1912. Table IV shows the various items of income and expense of all classes of central stations in 1912. Of the entire amount reported for free service, $4,982,995, representing a decrease from $6,010,595 in 1907, municipal central stations showed the larger part. They reported 89.7 per cent of the total in 1912 and 94.4 per cent in 1907.

The rank of the principal states in total income is as follows: New York, $57,218,973, or 18.9 per cent of the total for the United States; Illinois, $30,045,297, or 9.9 per cent; California, $27,685,573, or 9.2 per cent; Pennsylvania, $24,387,863, or 8.1 per cent; Massachusetts, $16,306,909, or 5.4 per cent; Ohio, $11,905,111, or 3.9 per cent; Michigan, $11,518,256, or 3.8 per cent; New Jersey, $10,944,367, or 3.6 per cent. In the totals reported for commercial light, power and heat New York led with $42,388,607, or 19.2 per cent of the aggregate amount. California was second with $19,941,719, or 9 per cent. Illinois had $19,693,842, or 8.9 per cent; Pennsylvania, $16,811,493, or 7.6 per cent. For municipal street lighting New York had $4,556,339, or 16.7 per cent of the total; Pennsylvania, $3,363,079, or 12.3 per cent; Massachusetts, $2,322,146, or 8.5 per cent. Illinois was the first State in the total of income reported for sales of energy to other public service corporations, with $5,231,534, or 16.9 per cent. New York had $5,090,032, or 16.4 per cent; California, $4,763,032, or 15.4 per cent; Pennsylvania, $2,801,257, or 9 per cent.

The cost of electric energy purchased increased from $2,130,759 in 1902 to $6,417,237 in 1907 and $18,074,344 in 1912. Most of this, namely, 94.2 per cent, 94.8 per cent and 93.6 per cent in the respective years, was reported by commercial stations, the balance being shown by municipal plants. Commercial central stations, reporting 92.8 per cent of the total expenses in 1912, showed an expenditure of 87.4 per cent of the total cost of fuel. Municipal stations, reporting 7.2 per cent of the total expenses, reported 12.6 per cent of the total expenditure for fuel.

Table V shows gross income for central electric stations, commercial and municipal combined, grouped according to dynamo rating. Of the total increase in income between 1902 and 1912 stations reporting a dynamo rating of 5000 kw or over showed 73.2 per cent;

TABLE III—COMMERCIAL AND MUNICIPAL CENTRAL STATIONS—AVERAGE COST OF CONSTRUCTION AND EQUIPMENT; PER KILOWATT RATING OF DYNAMOS AND PER HORSE-POWER OF PRIMARY POWER MACHINES

	Commercial			Municipal		
	1912	1907	1902	1912	1907	1902
Number of stations	3,659	3,462	2,805	1,562	1,252	815
Cost of construction and equipment	$2,098,613,122	$1,054,034,175	$482,719,879	$77,065,144	$42,879,447	$22,020,473
Kilowatt rating of dynamos	4,766,012	2,500,209	1,098,855	368,677	209,016	113,380
Average cost of construction per kilowatt rating of dynamos	$440	$422	$439	$209	$205	$194
Horse-power of primary power machines	6,969,320	3,776,837	1,685,020	559,328	321,351	160,028
Average cost of construction per horse-power of primary power machines	$301	$279	$286	$138	$133	$138

TABLE IV—INCOME AND EXPENSES OF COMMERCIAL AND MUNICIPAL CENTRAL STATIONS, 1912

	Amount	Per Cent of Total
Total income	$302,115,599	100.0
Electric service	$286,980,858	95.0
Commercial light, power and heat	221,270,466	73.2
Municipal street lighting	27,273,226	9.0
Municipal building lighting	2,504,511	0.8
Energy sold to other public service corporations	31,019,660	10.3
Estimated value of free service:		
Commercial stations	513,644	0.2
Municipal stations	4,469,351	1.5
Interest and dividends from investments	4,891,449	1.6
All other sources	10,243,292	3.4
Total expenses	$234,419,478	100.0
Fuel	$34,748,754	14.8
Electric energy and electric power purchased	18,074,344	7.7
Rent of offices, conduits, underground and water privileges	4,279,596	1.8
Supplies, materials, salaries and wages, and other miscellaneous expenses, not elsewhere specified	91,847,508	39.2
Taxes:		
Real and personal property	8,048,291	3.5
Capital stock	997,012	0.4
Federal corporation	558,706	0.2
Earnings	2,598,338	1.1
Miscellaneous	944,991	0.4
Interest on funded and floating debt	48,302,900	20.6
Injuries and damages	1,200,989	0.5
Insurance	2,320,151	1.0
Charges for depreciation	18,843,863	8.0
Charges for sinking fund	1,654,035	0.7

stations without generating equipment had 13.5 per cent. These two classes alone had 86.7 per cent of the total increase. Stations reporting dynamos of 5000-kw rating and over in 1912 had 62.4 per cent of the total income as compared with 35.3 per cent in 1902. Stations without generating equipment had 7.4 per cent of the total income in 1912 as compared with 1.8 per cent in 1902. The smallest increase in gross income for the decade is shown for stations having less than 200-kw rating.

TABLE V—GROSS INCOME FOR STATIONS GROUPED ACCORDING TO DYNAMO RATING

Class of Income	Census	Total	Stations Grouped According to Dynamo Rating						Stations Having no Generating Equipment
			Under 200 Kw	200 Kw and Under 500 Kw	500 Kw and Under 1,000 Kw	1,000 Kw and Under 2,000 Kw	2,000 Kw and Under 5,000 Kw	5,000 Kw and Over	
Number of stations	1912	5,221	2,902	948	337	214	152	161	507
	1907	4,714	3,038	821	269	169	116	74	227
	1902	3,620	2,587	586	172	98	67	32	78
Per cent of increase: 1902-1912	....	44.2	12.2	61.8	95.9	118.4	126.9	403.1	550.0
Gross income	1912	$302,115,599	$16,625,868	$18,111,238	$14,079,923	$16,518,054	$25,448,529	$188,434,343	$22,897,634
	1907	175,642,338	17,140,070	14,786,719	10,465,110	13,149,808	21,915,199	89,930,073	8,255,359
	1902	85,700,605	14,440,351	10,409,319	7,001,486	8,414,307	13,839,846	30,027,061	1,568,235
Per cent of increase: 1902-1912	....	252.5	15.1	74.0	101.1	96.3	83.9	527.5	1,360.1

Central-Station Balance Sheet of United States

Table VI shows a combined balance sheet for commercial and municipal central stations in the United States. In addition to the $977,639,057 common stock, $176,947,959 preferred stock and $897,907,681 bonds reported by commercial stations, $12,165,075 was shown as "cash" invested in central electric stations. This represents the cash capital of the 587 individuals, 293 firms and seven other forms of ownership engaged in generation of electrical energy.

TABLE VI—UNITED STATES CENTRAL ELECTRIC STATIONS—BALANCE SHEET, 1912

	Commercial	Municipa
ASSETS:		
Cost of construction, equipment and real estate	$2,098,613,122	$77,065,144
Stock and bonds of other electric companies	77,787,160	.....
Stock and bonds of companies other than electric	65,895,784	.....
Treasury securities:		
Stock	16,418,819	.....
Bonds	32,099,639	.....
Other permanent investments	10,825,932	41,336
Cash and current assets, including supplies	140,138,589	5,381,152
Stock and bond discount	20,229,893	18,432
Sinking and other special funds	9,939,237	1,659,098
Sundries	10,665,361	1,907,100
Profit and loss deficit for companies or stations showing a deficit	7,409,621	448,863
Total	$2,490,023,157	$86,521,125
LIABILITIES:		
Capital stock:		
Common	$977,639,057	.....
Preferred	176,947,959	.....
Funded debt	897,907,681	$31,189,357
Cash investments	12,165,075	27,064,963
Real-estate mortgages	10,170,898	344,608
Floating debt	137,726,385	4,959,382
Reserves	64,422,773	2,509,652
Accounts payable	40,936,406	1,347,263
Interest and taxes due and accrued	19,007,229	723,087
Dividends due	3,214,790	.....
Sundries	26,804,167	235,728
Profit and loss surplus for companies or stations showing a surplus	123,080,737	18,147,085
Net surplus	115,671,116	17,698,222
Total	$2,490,023,157	$86,521,125

Included in the census returns were also a few cases of large corporations engaged in other branches of industry which from local pride or sociological reasons furnished energy for the lighting of small towns in the immediate neighborhood. Investment in electrical equipment in such cases was carried as cash investment by the company.

Dimmers for Tungsten Lamps

As pointed out in a paper by Mr. F. E. Waller, entitled "Dimmers for Tungsten Lamps," which was presented before this week's meeting of the American Institute of Electrical Engineers in New York, the light given out by tungsten lamps cannot be satisfactorily regulated with dimmers designed for the control of carbon-filament lamps as the temperature coefficient of carbon is negative and that of tungsten is positive. For instance, if a carbon-filament and a tungsten-filament lamp having the same resistances when cool are raised to rated incandescence, the latter will have thirty-five times the resistance of the carbon filament. It is also interesting to note that the resistance of a 100-watt, 110-volt carbon-filament lamp changes very little between 10 watts and 100 watts input, but the resistance of a 40-watt, 110-volt tungsten-filament lamp (giving about the same candle-power as the carbon lamp) rises very rapidly from zero input to the rated power input. Unlike carbon-filament lamps tungsten lamps oppose every attempt at control and therefore must be regulated by much finer divisions of resistance, to obtain flickerless dimming.

If the candle-power of a tungsten lamp is to be decreased, enough extra resistance must be connected in series with it to compensate for the decrease in resistance. For example, in reducing the candle-power of a 40-watt, 110-volt tungsten lamp from half to quarter normal, about 50 per cent more resistance would have to be added than would be necessary if the filament had constant resistance. It was shown that from the volt-ampere curve of the lamps to be dimmed it is possible to determine the number of amperes which must be carried by the rheostat with different potential drops across the resistance. From the current corresponding to the voltage drop across the rheostat the resistance required can be computed and the size of the wire determined. With 110-volt tungsten lamps it was found that a 100-step dimmer with 1 volt regulation between steps was very satisfactory. On 120-volt circuits 110-step dimmers are necessary.

Protecting the Lineman

Linemen are subjected to considerable danger if high-voltage and low-voltage wires are intermingled on cross-arms. To minimize the chance of men coming in contact with high-voltage conductors, the Wichita Falls (Tex.) Electric Company is placing them on steel brackets fastened to the extreme ends of the upper cross-arms. These conductors include wires for series street lamps and transformer primary circuits. As transformers are usually hung on the lower arms, the primary leads are incased in rubber tubing and run down extreme ends of the cross-arms.

Progressive Public Policy and Its Results

Ideas Used with Success to Bring a Great Electric Utility Into Harmony with Its Patrons—Increase in Commercial and Residence Load

IN 1911 the Union Electric Light & Power Company of St. Louis, Mo., was supplying electrical energy to approximately 32,000 customers within the city limits of St. Louis. To-day the company's customers number over 56,000, showing an increase of 75 per cent since Jan. 1, 1912. During the same period the growth of residence business has been more than 100 per cent. Coincidently with this rapid development the company's rates have been repeatedly reduced, its output in kilowatt-hours has been greatly increased, and its earnings have maintained practically a straight line. A description of the methods employed to bring about these rapid and progressive changes and a narration of some of the incidents which have been characteristic in the company's success disclose essential principles in public policy.

FIG. 1—ELECTRIC SERVICE ON THE OUTSKIRTS OF ST. LOUIS

A Courteous Welcome to the New Customer

Customers' applications for electric service are received at a long counter on the ground floor of the company's general office building, only a step from the street. Enough courteous clerks are on hand to insure prospective customers receiving prompt attention. It is easy to transact business with the company, and St. Louis people come to the company's offices because of this fact and because the company through its advertising continually points out that electricity is desirable and convenient, reasonable in price and superior in quality to other sources of light. The local public is being educated to the idea that old houses can be wired at small expense by taking advantage of the company's deferred-payment plan. In co-operation with St. Louis electrical contractors, who become the company's solicitors under this plan, considerable residence business has been secured. The electric company carries these wiring accounts to a limited aggregate and finds that losses on funds thus invested have been remarkably small.

At the same time that the company was making plans and establishing these policies for its patrons' benefit changes were being made at intervals in the rates. Rate reductions have been carefully worked out and new schedules inaugurated, resulting in a substantial decrease in the average net rate for the past two years. For example, the average net residence-lighting rate for the month of August, 1911, was 13.48 cents per kw-hr. This year in August, with the reductions in rates and minimums, the average net residence-lighting rate was 8.87 cents per kw-hr. Table I shows comparative average annual net rates for different classes of service.

TABLE I—AVERAGE ELECTRIC RATES IN CENTS PER KW-HR.

Year	Residence Lighting	Commercial Lighting	Direct-Current Motor Service	Alternating-Current Motor Service	Total
1911	11.45	6.17	4.18	3.84	5.49
1913	8.03	4.53	3.11	2.98	3.90

Along with all the foregoing sweeping reductions, renewals have been made free for carbon-filament lamps and for tungsten lamps of 60-watt and larger sizes. The customer's minimum bill for residence lighting has been reduced from $1 to 50 cents. When this reduction in the minimum bill was made it was estimated that there would be a considerable annual loss in revenue per customer. But it also was anticipated that the volume of increased new business derived from small residence consumers would more than wipe out this expected loss. The outcome of the reduction has been practically as anticipated.

Increased Diversity of Load

With the increased business came also increased diversity of demand on the system, for the St. Louis people have continued to buy more motor service as well as lighting. Owners of isolated plants in the downtown district also have seen the saving which can be made with central-station energy, and to-day forty-seven of these plants have been taken over and are being operated by the Union Electric Light & Power Company.

FIG. 2—SERVING THE WORKMAN'S COTTAGE

While the company's rates have been "tobogganing," the average revenue per customer has also decreased from $11.83 in 1905 to $6.27 for 1913. There are, however, some very interesting exceptions to this general rule. Records of the bills of twenty large residence customers, kept continuously since 1900, are cited in

Table II, and show notable rate reductions but almost equal bills.

Success in continually acquiring new customers has not led the company's officers to underestimate the value of the good will of patrons already on the lines. The

TABLE II—DATA FROM BILLS OF TWENTY LARGE RESIDENCE CUSTOMERS

Year	Average Kw-hours Used Annually	Annual Bills	Cents per Kw-hour
1900	376	$68.05	18.12
1914	1061	65.00	7.02

smallest customer with a complaint has ready access to the office of any department head as well as to the office of the general manager.

As an example of the service friendly small customers can sometimes render a public utility company, the story is told of a large motor-service customer who believed he had been overcharged. He proceeded to make known his beliefs in his own office. His accountant overheard the outbreak, averaged his employer's bills of the previous year, and compared the result with the bill which had raised the motor user's ire. The comparison changed the aspect of the situation. It showed that the charge was correct, and hence the complaint never reached the electric company's office directly. This complaint was headed off because the accountant, a small customer of the Union Electric Light & Power Company, had always received prompt service and courteous treatment and felt sure that by checking over the bills paid he could show that the electric company did not make overcharges.

Efficient Trouble Department Pleases Customers

Records show that only 7 per cent of the complaints registered are justified. However, a careful analysis of every "kick" is made, and the findings in each case are recorded and filed. The company's method of handling and recording complaints would make a complete and interesting story in itself. One feature of this work, the operation of the trouble department, should be spoken of here, however, for successful handling of cus-

FIG. 3—HOW THE CORNER STORE IS REACHED

tomer's troubles is essential to the preservation of favorable public sentiment.

The trouble department of the company consists of careful men, some of whom have been in the employ of the Union Electric company for more than fifteen years. If a customer calls the trouble department night or day, one of these men will speedily arrive at the scene of the trouble. On an average the men arrive at their destination fifteen minutes from the time the customer calls. With their automobiles and motorcycles they can reach even the most remote customer in less than twenty-five minutes. When the trouble-man arrives at the customer's premises, having with him the customer's telephoned report of the trouble, he rings the doorbell, calls

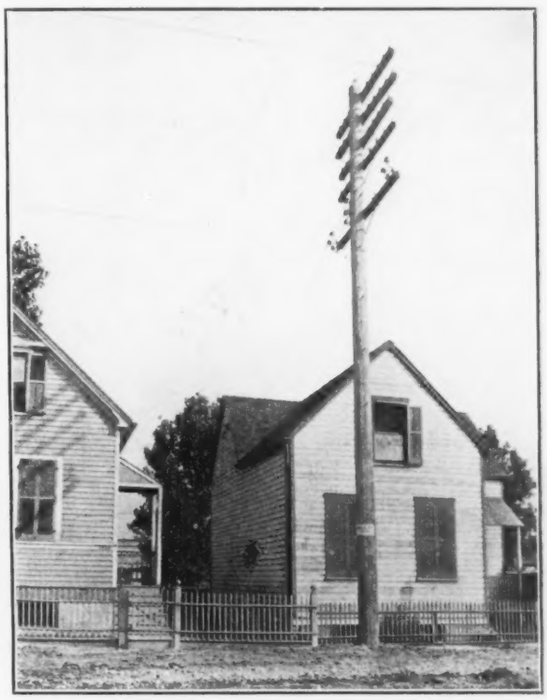


FIG. 4—THREE SERVICE LINES FROM ONE POLE

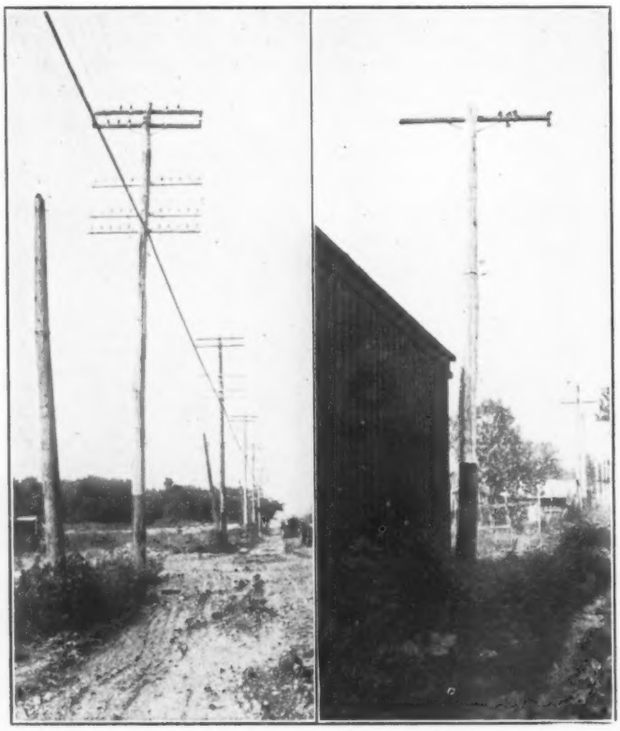
out "Union Electric," letting the complainant know that the company's representative is on the job, and goes on about his business. The chances are that the trouble will be found at the transformer fuse plugs, and that the trouble-man will not need to enter the customer's house. He does not enter unless it is necessary.

Sometimes a charge for the trouble-man's services is necessary, but he has instructions not to mention the question of price. Charges for trouble service when necessary are recorded by trouble-men and added to customer's bills by the accounting department, with a memorandum stating the cause for the charge. Remembering the prompt repairs, the customer pays the charge added to his bill usually without question. Had the trouble-man before he did the work told the customer that there would be a charge, the latter might have felt that the company was imposing on him.

Another idea which has been successfully used to establish friendly relations with patrons is the practice of remitting discounts or penalty charges the first time a customer allows his bill to become overdue. The plan is worked out in this manner: If a customer sends in a check for the full amount of an overdue bill, the cashier receiving the check determines whether this customer has ever been delinquent before. If he has not been delinquent previously, a check for the amount of the discount is sent to him with a letter stating that since his payments have been prompt in the past, this instance being an oversight, the company believes him entitled to the discount. Overdue bills paid at the counter are handled in like manner with an oral explanation.

To make each patron a larger user of electric service is another problem in the solution of which much has been accomplished. The estimated revenue to be de-

rived from small residence customers when they are first taken on is $9.50 a year. Residence customers in St. Louis used 34 per cent more kilowatt-hours and paid the company 28 per cent more revenue in August this year than in August of last year. Their increased use of electricity more than offset the decrease which was felt in the motor-service load due to slackening activities



FIGS. 5 AND 6—TYPES OF CONSTRUCTION IN STREETS AND ALLEYS

of manufacturing establishments. This has resulted doubtless because the factory worker, when work has been slack, has had less money to spend for evening diversions. Hence he probably stayed at home to read, and his use of electricity for lighting has accordingly increased. From this viewpoint the small-customer business is regarded as a valuable asset.

80,000 Lamps Sold in Six Days

Forced lamp renewals have been made in St. Louis periodically as a means of maintaining satisfied customers and increasing the company's connected load. This fall a special lamp offer covering the last six days in September was tried with notable success. Thirty-five thousand post cards were sent to the company's residence customers. The cards carried the company's offer to renew all old lamps above 60-watt sizes free and to fill all empty lamp sockets with new lamps at prices 25 per cent below the regular selling price. Approximately 20 per cent of the company's residence customers availed themselves of this offer. Eighty thousand lamps were sold during the six days, and a surprisingly large number of kilowatts of unity-power-factor connected load was added to the company's lines without any line construction, transformer or meter expense. The profit from the lamps sold outright more than covered the expense for the labor of handling the lamp sale. The only real expense incurred will be that of renewing a portion of the 80,000 new lamps when they are "burned out." However, by that time they will have earned the cost of renewal in the energy they have consumed.

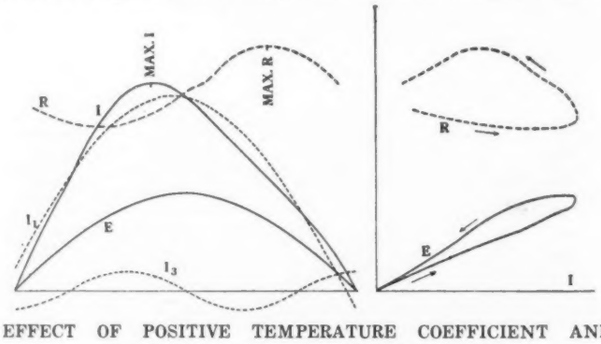
To summarize, the Union Electric Light & Power Company's officers seem to believe that the small residence customer is an asset even though his bill be less than $1.50 a month; democratic executive spirit is everywhere manifest, and no effort is spared which will cement more closely the amicable relationship existing between the public and the company and between the company and its employees.

Distortion of Alternating-Current Waves

In a paper, "Distortion of Alternating-Current Waves Caused by Cyclic Variation in Resistance," presented before the American Institute of Electrical Engineers at New York City on Feb. 18, by Messrs. Frederick Bedell and E. C. Mayer, it was pointed out that an alternating current will not have exactly the same wave-form as the electromotive force if the resistance of the circuit changes during the cycle as is the case when the circuit includes incandescent lamps. Instead of producing a simple sine wave of current through a lamp circuit, a simple sine electromotive force produces a complex current wave made up of a fundamental and or one or more higher harmonics. Even harmonics cannot be present in the complex wave unless the resistance has different values for positive and negative currents. Particular attention was given to the third harmonic and the cyclic changes in resistance corresponding to it.

When the third harmonic is in time phase with the emf wave it tends to flatten the resultant current wave. This condition is caused by a positive temperature coefficient which does not lag and has twice the frequency of the current wave. If the temperature coefficient is positive and the variations in temperatures lag behind the emf wave, the third harmonic will also lag, thereby causing the fundamental wave to be advanced in phase. With a negative temperature coefficient and a maximum temperature occurring at the peak of the emf wave, the effect is to produce a peaked current wave instead of a flattened one. With a temperature lag the fundamental current will also lag.

Based on the condition that the instantaneous values of the fundamental and third harmonic must be equal and opposite at the moment when the emf is zero, and that the third harmonic is 10 per cent of the fundamental, it was shown that the lead or lag of the latter cannot exceed 5.75 deg. and would be less if the third harmonic were less. It was pointed out that to form any harmonic above the third it would be neces-



EFFECT OF POSITIVE TEMPERATURE COEFFICIENT AND RESISTANCE LAG ON CURRENT WAVES

sary for the resistance curve to contain a point of inflection. There will be no power in any harmonic in the current unless there is a corresponding harmonic in the emf wave. The power-factor is equal to the product of the fundamental power-factor and a distortion factor, which may be between 0.990 and 0.995 with a third harmonic of 10 per cent.

CENTRAL-STATION OPERATIONS

Totals of Income and Output in First Four Months of War Period Show an Increase

According to returns received by the ELECTRICAL WORLD, it was not until November, 1914, that electric utility companies showed, as a result of conditions arising from the European war, a decrease in income. The decrease in that month was slight, the total being 1.8 per cent below that for the corresponding month of the previous year. In August companies began to feel the pinch of war. In that month and in September the totals of income from the sale of energy showed a decreased rate of growth. The most noticeable changes, however, were in the percentage increase in output, which dropped from 23.8 per cent in July to 8.2 per cent in August. In October, however, when the heavy lighting loads began to come on, companies felt the almost universal practice of domestic economy. It will be noticed in Table I that the percentage growth in income decreased from 7 per cent in September to 2.8 per cent in October, while at the same time the percentage growth in output dropped from 6.8 per cent to 3.7 per cent.

During the period from Aug. 1 to Nov. 30 New England central stations were affected less than those in any other section of the country, according to the statistics received. During the months previous to the war companies were showing a rate of growth in gross income of approximately 9 per cent, and during the first four months of the war the lowest percentage growth was reached in October, namely 4 per cent. In output the percentage growth was reduced practically one-half, reaching the low mark in October. Utilities in the Atlantic States and the Far Western States seem to have had a large loss in motor-service loads. Both sections have shown a steady decrease in the percentage growth in output, and for November they showed an actual decrease as compared with November, 1913. In the Central States Illinois was excluded owing to incomplete returns from that State. The operations of the companies reporting from this section still show a very satisfactory growth. The full effects of the war were felt immediately by companies in the Central States in a reduced rate of growth in output in August, but substantially the level then reached has been maintained.

While the figures in Table I are not exactly comparative, because different numbers of companies reported for the different months, Table VI, giving figures from 51 per cent of the industry for each of the months named, shows that in general the percentage growths in the two tables were not far apart. Particularly is this true of income. In the figures for percentage growth in output, however, there is a slight change, and the comparative figures are better than those which show varying percentages of the central-station industry for the different months. This is owing primarily to the returns from one very large company supplying only wholesale energy which has had to reduce its output considerably, not because of the present depression but because of legal difficulties.

Based on the 1910 census, the returns have been segregated into groups, according to the sizes of the communities served, for September, October and November. Group 1 contains figures for cities of over 100,000 population; group 2, for cities between 50,000 and 100,000; group 3, cities between 25,000 and 50,000; group 4, between 10,000 and 25,000, and group 5, between 5000 and 10,000. Except where otherwise stated, the percentages are increases. September showed: Group 1, 8 per cent in income, 5.5 per cent in output; group 2, 8.2 per cent in income, 14 per cent

TABLE I—CENTRAL-STATION RETURNS FOR HALF-YEAR PERIOD

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May (45 per cent of industry)	$14,295,321	$13,099,007	9.1	674,877,591	602,832,337	12.0
June (45 per cent of industry)	14,073,840	12,996,198	8.3	682,791,096	603,122,008	13.3
July (50 per cent of industry)	14,086,822	12,970,325	8.5	803,849,850	649,720,026	23.8
August (51 per cent of industry)	15,298,226	14,200,649	7.8	778,109,565	718,274,456	8.2
September (51 per cent of industry)	15,708,695	14,694,205	7.0	782,450,267	733,754,420	6.8
October (59 per cent of industry)	17,667,912	17,174,567	2.8	969,817,024	935,249,519	3.7
November (65 per cent of industry)	19,490,500	19,870,880	1.8*	967,060,825	956,450,460	1.1

*Decrease.

TABLE II—CENTRAL-STATION OPERATIONS FOR NEW ENGLAND STATES

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May (55 per cent of industry)	$1,745,160	$1,609,234	8.4	52,752,247	50,779,103	3.9
June (58 per cent of industry)	1,560,872	1,442,178	8.3	53,463,013	48,049,756	11.1
July (60 per cent of industry)	1,670,819	1,530,410	9.2	54,074,533	49,255,893	9.8
August (61 per cent of industry)	1,734,583	1,607,649	7.5	55,801,224	52,913,483	5.4
September (61 per cent of industry)	1,766,587	1,647,945	7.3	55,525,272	53,267,877	4.3
October (64 per cent of industry)	1,963,579	1,889,255	4.0	67,520,070	65,068,938	3.8
November (67 per cent of industry)	2,234,604	2,120,414	5.4	69,470,163	66,852,632	3.9

TABLE III—CENTRAL-STATION OPERATIONS FOR THE ATLANTIC STATES

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May (58 per cent of industry)	$6,492,767	$5,628,718	14.5	259,098,542	238,733,320	8.4
June (54 per cent of industry)	6,067,780	5,578,311	6.0	244,936,886	221,315,464	10.8
July (54 per cent of industry)	6,152,169	5,583,309	10.2	263,580,299	235,068,939	11.8
August (55 per cent of industry)	6,224,896	5,755,515	8.2	264,717,319	237,984,895	11.2
September (55 per cent of industry)	6,608,221	6,221,000	6.1	270,974,533	252,648,550	7.3
October (67 per cent of industry)	7,451,220	7,232,063	3.1	358,458,539	351,362,247	2.1
November (69 per cent of industry)	8,385,409	8,031,293	4.4	357,116,840	360,908,874	1.0*

*Decrease

in output; group 3, 4.2 per cent in income, 2.7 per cent in output; group 4, 10 per cent in income, 9.5 per cent in output; group 5, 9.1 per cent in income and 4 per cent in output.

October showed: Group 1, 4.2 per cent in income, 3.25 per cent in output; group 2, 4.7 per cent in income, 5.2 per cent in output; group 3, 1.2 per cent in income, 4.6 per cent decrease in output; group 4, 15.1 per cent in income, 6.3 per cent in output; group 5, 3.5 per cent in income, 2.9 per cent in output.

November showed: Group 1, 2.6 per cent in income, 0.8 per cent in output; group 2, 4.7 per cent in income, 4.2 per cent in output; group 3, 0.5 per cent in income, 7.2 per cent decrease in output; group 4, 4.8 per cent in income, 5.7 per cent in output; group 5, 1.5 per cent in income, 2.6 per cent decrease in output.

It is thus seen that the rate of growth of companies in the larger cities steadily decreased. Companies in group 2, while showing a decreased rate of growth, in output; group 5, 17.8 per cent in income, 9.7 per cent decrease in output. October—Group 1, 5 per cent in income, 4.2 per cent in output; group 2, 2.3 per cent in income, 1 per cent in output; group 3, 6.1 per cent in income, 6.6 per cent in output; group 4, 5.8 per cent in income, 14.2 per cent in output; group 5, 8 per cent in income, 8.1 per cent decrease in output. November—Group 1, 6.1 per cent in income, 6.9 per cent in output; group 2, 2.3 per cent in income, 1.5 per cent decrease in output; group 3, 9.7 per cent in income, 7.5 per cent in output; group 4, 9 per cent in income, 4.2 per cent in output; group 5, 3.9 per cent in income, 8.3 per cent decrease in output.

Atlantic States: September—Group 1, 7.8 per cent in income, 7.1 per cent in output; group 2, 6.1 per cent in income, 15.6 per cent in output; group 3, 7.9 per cent in income, 15.4 per cent in output; group 4, 8.3 per cent in income, 2.2 per cent in output; group 5, 10 per cent in income, 26.8 per cent in output.

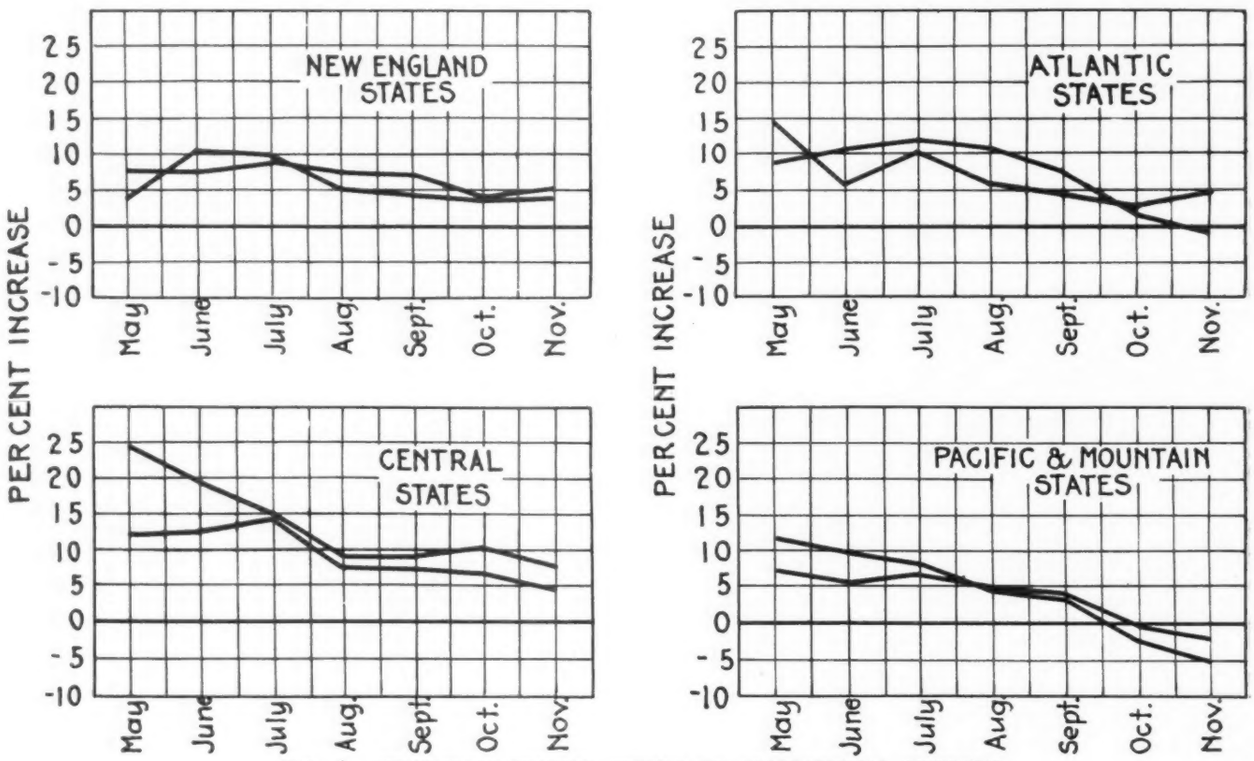


FIG. 1—PERCENTAGE-GROWTH CURVES BY GEOGRAPHICAL DIVISIONS

were about steady in October and November. The medium-sized cities in group 3 have also shown a steady downward trend, even registering decreases in October and November. The companies in group 4, although doing well in income in September and October, showed decreased rates of growth in November. The group 5 companies showed results which were steadily downward. Figures in groups 4 and 5 do not contain so large a percentage of the operating companies as do the other groups, and therefore less emphasis is placed on them.

In order to show the local effects of present conditions, figures for these groups were compiled separately for the New England States, Atlantic States, Central States and Pacific and Mountain States. As in the other computations, the percentages are increases unless otherwise stated. New England: September—Group 1, 5.8 per cent in income, 2 per cent in output; group 2, 6.3 per cent in income, 12 per cent in output; group 3, 7 per cent in income, 7.4 per cent decrease in output; group 4, 3.9 per cent in income, 15 per cent October—Group 1, 6.2 per cent in income, 4.6 per cent in output; group 2, 7.1 per cent in income, 10.3 per cent in output; group 3, 1.4 per cent in income, 6 per cent decrease in output; group 4, 6.8 per cent in income, no change in output; group 5, 10.2 per cent in income, 46.5 per cent in output. November—Group 1, 3 per cent in income, no change in output; group 2, 2.7 per cent in income, 5 per cent in output; group 3, a very slight decrease in income, 8.5 per cent decrease in output; group 4, 4.8 per cent in income, 3.8 per cent in output; group 5, 13.5 per cent in income, 57.5 per cent in output.

Central States: September—Group 1, 7.7 per cent in income, 5.7 per cent in output; group 2, 9.5 per cent in income, 21 per cent in output. October—Group 1, 7 per cent in income, 6.3 per cent in output; group 2, 4.7 per cent in income, 11.2 per cent in output; group 3, 4 per cent in income, 5 per cent in output; group 4, 8.1 per cent in income, 7.8 per cent in output; group 5, 1.6 per cent in income, 5 per cent in output. November—Group 1, 4.7 per cent in income, 2.4 per

cent in output; group 2, 5.2 per cent in income, 14.8 per cent in output; group 3, 4 per cent in income, 6.6 per cent in output; group 4, 4.3 per cent in income, 8.3 per cent in output; group 5, 0.5 per cent decrease in income, 4.9 per cent increase in ouptut.

Pacific and Mountain States: September—Group 1, 7.5 per cent in income, 2.3 per cent in output; group

TABLE IV—CENTRAL-STATION OPERATIONS FOR THE CENTRAL STATES (ILLINOIS EXCLUDED)

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May (43 per cent of industry)	$3,200,553	$2,841,685	12.7	202,611,026	162,363,929	24.8
June (52 per cent of industry)	3,914,836	3,459,497	13.2	217,920,183	182,406,207	19.4
July (52 per cent of industry)	3,802,126	3,307,719	15.0	217,928,950	188,569,581	15.6
August (57 per cent of industry)	4,389,696	4,051,678	8.4	267,501,400	226,276,638	9.4
September (57 per cent of industry)	4,704,780	4,368,251	7.9	260,705,339	237,832,934	9.7
October (57 per cent of industry)	5,105,810	4,783,847	6.8	295,490,712	266,827,567	10.5
November (57 per cent of industry)	5,389,711	5,152,431	4.6	283,615,647	261,882,231	8.2

2, 13.1 per cent in income, 4.5 per cent decrease in output; group 3, 3.8 per cent in income, 2.7 per cent in output; group 4, 17.7 per cent in income, 12 per cent in output; group 5, 4.4 per cent in income, 7.2 per cent decrease in output. October—Group 1, 0.3 per cent decrease in income, 1.6 per cent decrease in output; group 2, 2 per cent in income, 13 per cent

TABLE V—CENTRAL-STATION OPERATIONS FOR THE PACIFIC AND MOUNTAIN STATES

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May (57 per cent of industry)	$1,525,729	$1,426,885	7.0	144,839,552	129,357,915	11.9
June (67 per cent of industry)	1,894,887	1,791,918	5.8	155,326,455	141,836,377	9.6
July (72 per cent of industry)	2,212,827	2,068,249	6.8	183,160,015	169,718,387	7.9
August (75 per cent of industry)	2,386,677	2,282,061	4.6	193,216,699	185,330,705	4.2
September (75 per cent of industry)	2,487,513	2,398,176	3.7	190,979,705	185,090,658	3.2
October (85 per cent of industry)	3,146,160	3,157,689	0.3*	245,966,868	252,047,828	2.4*
November (88 per cent of industry)	3,491,286	3,577,862	2.2*	257,143,337	271,035,964	5.0*

*Decrease.

decrease in output; group 3, 1.7 per cent decrease in income, 7.3 per cent decrease in output; group 5, 0.1 per cent in income, 1.1 per cent in output. November—Group 1, 2.4 per cent decrease in income, 2.1 per cent decrease in output; group 2, 1.1 per cent in income, 17.7 per cent decrease in output; group 3, 3.5 per cent decrease in income, 14.1 per cent decrease in output; group 4, 1.4 per cent in income, 4.4 per cent in output; group 5, 3.1 per cent decrease in income, 2.9 per cent decrease in output.

The accompanying curves show the percentage increase or decrease in income and output by months from May to November inclusive. The curve starting below the other one at the left hand in every case represents the percentage increase for income, and the

TABLE VI—COMPARATIVE FIGURES FOR 70 PER CENT OF INDUSTRY OVER A THREE-MONTH PERIOD

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
September	$15,708,695	$14,694,205	7.0	782,450,267	733,754,420	6.8
October	16,976,816	16,443,831	3.3	911,982,671	876,944,255	4.0
November	17,840,812	18,185,093	1.7*	804,960,227	780,632,582	3.0

*Decrease.

other curve that for output, except in the chart for the Atlantic States, where the reverse is true. It will be seen from the curve for the Pacific and Mountain States that the percentage growths for output and income have undergone practically the same changes. This similarity, although marked in the case of the other sections, is not so pronounced as in the Far West.

From Table I it is found that the aggregate operations for the first four months of the war period were well in advance of the corresponding period of the previous year. The total gross income for the nation's

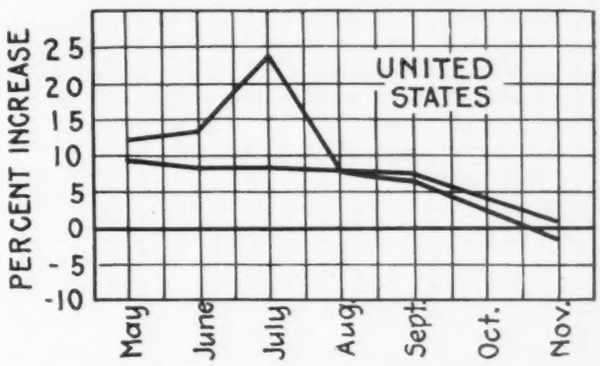


FIG. 2—PERCENTAGE-GROWTH CURVES FOR ENTIRE COUNTRY

central stations was 6.8 per cent ahead of the corresponding period of the previous year, and the total output was 5.8 per cent in advance. With the companies showing an increase in income of over 8 per cent in the previous months, it is calculated that in 1914 they were between 7 and 8 per cent ahead of 1913 in gross income.

Bursting Flywheels May Cause Boiler Explosions

In the January bulletin of the Fidelity & Casualty Company of New York it is pointed out that if the planes of fast-revolving flywheels are in line with boilers bursting of the wheels is liable to cause boiler explosion. If this happens, the owner will not be compensated for his loss unless he carries flywheel insurance, as boiler insurance policies cover losses resulting only from the force of steam. A policy covering flywheel insurance, of course, would cover damages to both in cases of this kind.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Derivation of the Wave-Form of Flux from the Wave-Form of Electromotive Force.—FRED. BEDELL AND RALPH BOWN.—A discussion of the following methods: Use of integrating commutator and direct-current voltmeter; mechanical and graphical methods of determining areas; analysis into harmonic components and mathematical integration; addition of ordinates with trapezoidal approximation; addition of ordinates with parabolic approximation. A comparison of the methods is also given.—*Elec. Journal,* January, 1915.

Calculation of Electric Windings.—GEORG MEYER.—A table and diagram are given which simplify the calculations of the electric data from the external dimensions of wound coils. The new feature is that instead of the "space factor" the ratio of conductor cross-section to space factor is made the basis of the calculation. Formulas are given which must be used in connection with the table and diagrams.—*Elek. Zeit.,* Jan. 7, 1915.

The Effect of the Shape of the Pressure Wave Upon the Operation of Rotary Converters.—The author shows that the presence of higher harmonics in the pressure wave of supply has a bad effect on the commutation of rotary converters. He shows by means of oscillograms that the commutation is greatly improved by the use of choking coils.—From *Archiv f. Elektrotechnik;* abstracted in London *Electrician,* Jan. 22, 1915.

Direct-Current Generators.—B. G. LAMME.—In a continuation of his illustrated serial on the development of the direct-current generator in America the author gives the history of the development of constant-current generators and motors under the following headings: the bipolar generator, multipolar types, slotted armature types, other multipolar types and engine-type generators.—*Elec. Journal,* February, 1915.

Lamps and Lighting

Signal Lamps.—L. BLOCH.—In electric installations signal lamps are widely used to indicate whether current really passes through an energy-consuming apparatus. These incandescent lamps are usually connected in parallel with the apparatus, and hence they indicate only the presence of emf and not the current in the apparatus. This difficulty is overcome by the use of signal lamps connected in series with the apparatus. Such lamps are made in ten different types, according to the current, up to 12 amp. The emf is 1 volt. These lamps also protect the circuit against overloads since with continuous great overload the lamps burn out in a few minutes. They are not intended, however, to replace fuses, which must be employed to provide against instantaneous short-circuits. The fuse is mounted together with the lamp. The different uses for which these signal lamps are suitable are discussed. —*Elek. Zeit.,* Jan. 21, 1915.

British Lamp Works.—An illustrated description of the Edison and Swan Electric Lamp Works.—London *Electrician,* Jan. 29, 1915.

Generation, Transmission and Distribution

Open-Delta Connection of Transformers.—GEORGE P. ROUX.—The merits of the scheme of employing the open-delta or V-connection of transformers in a case of emergency or as a permanent condition has often been questioned. The proposition has been both opposed and defended. The present article presents an analysis of the matter, and after considering the scheme from the standpoints of capacity, stresses, stability, etc., the following conclusions are reached: The T, double-T or Scott connection of two transformers for three-phase operation is more economical than the open-delta connection, on account of the somewhat greater available kva. However, since the open-delta connection requires no taps, it permits a greater simplicity in the construction of a transformer, which naturally lowers the cost of the unit and renders attainable a greater degree of ruggedness for the same cost than can be obtained in a transformer for T-connection which requires taps. Transformers without taps are better balanced internally to withstand electromagnetic and electrostatic stresses. There may be cases, however, where transformers having special taps for the T-connection might well be found useful in times of emergency or in cases of temporary installation, because of their greater kva available.—*Gen. Elec. Review,* January, 1915.

Installations, Systems and Appliances

Electrification of Flour Mills.—ERNEST P. HOLLIS.—An article discussing the various operations in a flour mill, analyzing critically the objections which are usually raised against their electrification, and explaining the advantages of such an electrification.—London *Elec. Review,* Jan. 22, 1915.

Overload Protection on Alternating-Current Circuits by Tripping Devices.—C. C. GARRARD.—The author first gives brief notes on the direct connection of circuit-breaker trip currents on the secondary of series transformers and the use of instantaneous and inverse-time-element relays for overload protection. Time-element relays have the advantage that several of them can be arranged in series so that they will operate in predetermined order. Fig. 1 shows the layout of an important plant in continental Europe. There are three maximum time-element relays in series—(1) primary of transformer relay, (2) secondary of transformer relay, (3) feeder and synchronous motor relays. It is necessary to set the above three relays in such a manner that the order in which they will operate, in the event of a sufficient current flowing, will be first (3), then (2) and then (1). This sequence must hold good under all

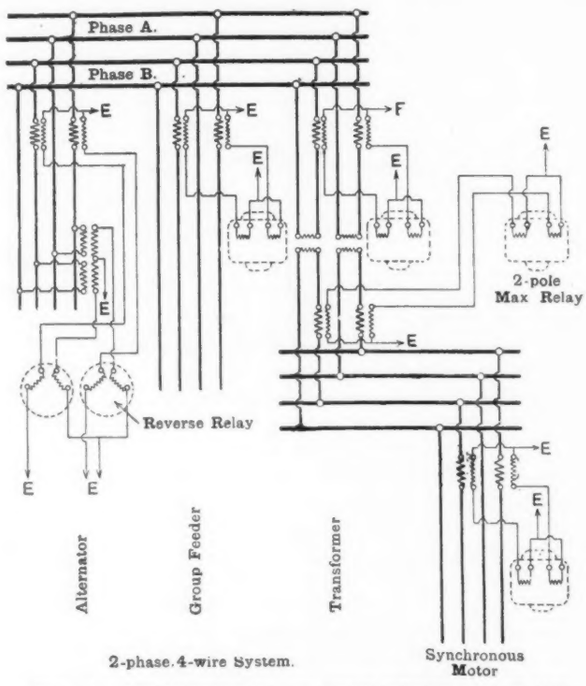


FIG. 1—ARRANGEMENT OF TIME-ELEMENT RELAYS

conditions, no matter how great the overload. A study of calibration curves is important. Any circuit-breakers with calibration curves which cut the axis of abscissas are unsuitable since this means that they will become instantaneous by acting for a certain finite current so that the discriminating character of the relays will be lost. Fig. 2 represents the curves of relays correctly designed for the scheme of Fig. 1. These curves give the calibrations of the relays themselves. To get the corresponding calibrations when used in conjunction with the series transformers, one has simply to multiply the horizontal ordinates by the ratio of the series transformer. The important point is that these curves are asymptotic at large overloads to certain definite times. Thus, no matter what overload is put on, the minimum times are never less than two, one and four-tenths and one second for *A*, *B* and *C* respectively. The reason of the existence of a minimum time is that the particular relays in question operate on the induction principle, and the minimum time corresponds to synchronous speed of the rotor. With moderate overloads the disk revolves below synchronism, owing to the damping. By suitable dimensioning of the parts any minimum time can be made to correspond to synchronous speed of the disk. It follows that under all conditions, including that of very heavy overloads, the relays will operate in the order *C*, *B* and *A*. The author then discusses the influence of nature of load on allowable time elements of alternating-current automatic circuit-breakers, and finally, with the aid of diagrams, shows how to make correct connections of maximum-current relays on three-phase circuits. The article is to be concluded.—London *Electrician*, Jan. 29, 1915.

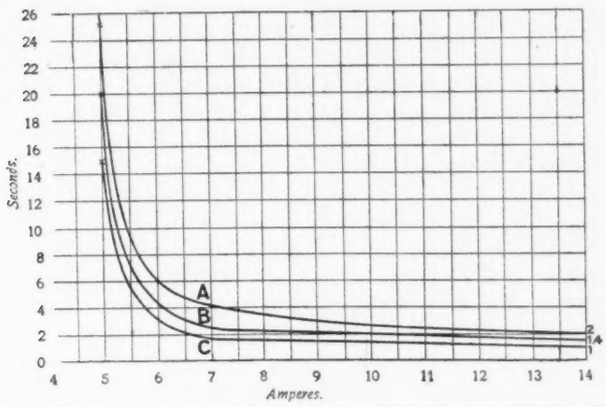


FIG. 2—CALIBRATION CURVES OF INVERSE TIME-ELEMENT RELAYS

Wires, Wiring and Conduits

Effect of Altitude on the Spark-Over Voltages of Bushings, Leads and Insulators.—F. W. PEEK, JR.—The author gives the results of extended tests on the effect of altitude (or air pressure) and temperature on the insulator spark-over voltages. When sufficient data regarding an insulator are given, the tabulations and charts in this article enable one to determine the spark-over voltage at any temperature and atmospheric pressure.—*Gen. Elec. Review*, February, 1915.

Electrophysics and Magnetism

Corona Phenomena.—E. H. WARNER.—An abstract of an American Physical Society paper. It has been shown by S. P. Farwell that at the instant the corona appears the pressure in the corona apparatus increases. In a former paper Mr. Farwell shows the relation of this increase in pressure and the difference of potential. According to the ionization theory, the corona current should be directly proportional to this increase in pressure. To test this relation experiments have been performed upon dry air and nitrogen with potential differences up to 15,000 volts. With the wire positive it has been found that the current is directly proportional to the increase in pressure. With the wire negative the relation is direct for lower voltages, but with higher voltages the pressure increases more rapidly than the current. In this case the currents are larger and, therefore, the heating effects more prominent. This variation from the direct proportion may be explained by the fact that in the apparatus used the increase in pressure could not be measured before the current caused a temperature increase which added to the measured pressure increase. Several attempts have been made to construct a high-potential voltmeter based upon this principle.—*Physical Review*, January, 1915.

The Leduc Effect in Some Metals and Alloys.—ALPHEUS W. SMITH AND ALVA W. SMITH.—If a metal plate having a longitudinal flow of heat in it is placed in a magnetic field which is perpendicular to the plane of the plate, a transverse difference of temperature is observed. This effect may be described as a rotation of the isothermal by the magnetic field and is known as the Leduc effect. In the magnetic metals, nickel, nichrome, iron and cobalt, the transverse difference of temperature set up by the magnetic action in the case of the Leduc effect is proportional to the intensity of magnetization in the plate and not to the intensity of the magnetic field. This difference of temperature, therefore, reaches its maximum value when the intensity of magnetization has become a maximum. The relation of this effect to the magnetic field which produces it is the same as the relation of the Hall effect and the Nernst effect to the magnetic field. In antimony the Leduc coefficient is independent of the intensity of the magnetic field. The Leduc coefficient has been determined in tungsten, molybdenum, cadmium, a series of alloys of antimony and bismuth, and a series of alloys of antimony and zinc. The addition of antimony to bismuth decreases the Leduc coefficient but less rapidly than is to be expected from the additive law. The addition of zinc to antimony causes a very rapid decrease in the Leduc coefficient. An alloy containing 10 per cent of zinc and 90 per cent of antimony exhibits the Leduc effect to the extent of only one-sixth of that in pure antimony. With the further increase in the amount of zinc the coefficient decreases to a not very well-defined minimum from which it rises to the value in zinc.—*Physical Review*, January, 1915.

Absolute Zero.—S. DUSHMAN.—Following a note on conceptions of temperature, the principles of gas thermometry and the absolute scale of temperature are discussed. The author then describes methods of obtaining low temperatures and liquefying gases.—*Gen. Elec. Review*, February, 1915.

Rotating Field Model.—F. M. DENTON.—An illustrated description of a simple form of apparatus by the aid of which both the distribution and the manner of rotation of a multipolar field may be demonstrated. The method involves the use of iron filings.—London *Electrician*, Jan. 22, 1915.

Units, Measurements and Instruments

Mercury Stream Regulator.—FRANZ BEUTL.—An illustrated description of a quick-acting regulator using a mercury stream which may be employed for maintaining constant the voltage on electrical machines. The arrangement is shown in Fig. 3. The apparatus consists of a vessel *c*, a contact wheel *b* which is built in star form, a mercury stream *a*, a regulating electromagnet *d*, a valve *e* and the pump *f*. The contact wheel *b* and the vessel *c* (or, what is the same, mercury stream *a*) are connected to the shunt regulator terminals. The

GRIPPER & SIDE GUIDE

contact wheel *b* is, of course, insulated for the vessel *c*. The coil of the regulating electromagnet *d* is connected according to the requirements of the case to the network. The contact wheel *b* and the pump *f* are revolved by some available source of power. The horizontal contact wheel *d* is designed as a star, the arms of the star being wider near the center than the ends so that the

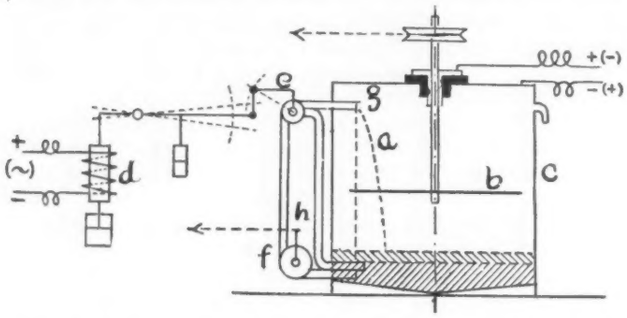
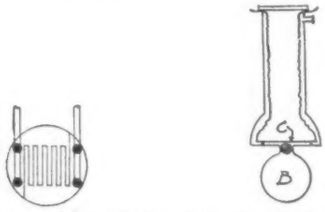


FIG. 3—ARRANGEMENT OF MERCURY STREAM REGULATOR

ratio of the period for which the shunt regulator is short-circuited to the period during which it is not depends on the point where the mercury stream drops on the contact wheel. This is regulated automatically by means of the electromagnet *d*, which acts on the valve *e*, which in turn opens or closes more or less the exit holes of the pipe *g* for the mercury stream and of the pipe *h* for the pump.—*Elek. u. Masch.* (Vienna), Dec. 27, 1914.

Selenium Cell.—D. S. ELLIOTT.—The author first describes a new construction of selenium cells, due to Pfund. It is particularly adapted for low-temperature work. Amorphous selenium was first cast into disks about 1.5 cm in diameter and 1.5 mm thick. They were sensitized in the usual way, being maintained at a temperature of 200 deg. C. for six hours and then cooled rapidly to room temperature. The disks were then ground smooth on crocus cloth, after which silver tape electrodes were fastened on with celluloid. A film of gold was next deposited by cathode sputtering, and finally the gold was removed along a narrow line like a grid as shown in Fig. 4. The four shallow pools of celluloid shown strengthen the construction and provide a smooth transition from the selenium to the upper surface of the silver tape. In this way fractures of the gold film were avoided. The time required for the deposition from the insertion of the cell to its removal did not exceed twenty minutes, but as a matter of fact the selenium was covered with a protective layer of gold within six minutes. No deleterious action due to mercury vapor could be detected. The cell was finally inclosed in a glass tube similar in design to that shown in Fig. 5. Bulb *B* was filled with calcium chloride and the constriction leading to the upper chamber was



FIGS. 4 AND 5—DESIGN FOR SELENIUM CELLS

loosely plugged with cotton. The cell *c* was fastened with sealing wax in this upper chamber, the end of which was closed by a glass plate. The vessel was also provided with a side tube for exhausting by means of an aspirator, a phosphorous pentoxide tube being inserted between cell and aspirator during the process. Stibnite cells were also made and a comparative study was undertaken of the light sensibility of selenium and stibnite at 20 deg. C. and —190 deg. C. The sensibility curves of selenium and stibnite at 20 deg. C. and —190 deg. C. show that lowering the temperature causes: (a) a shift of the sensibility maximum toward the region of shorter wave-lengths by about 600 anstrom units, for both stibnite and selenium; (b) an extension of range of sensibility from 0.9 μ to at least 2 μ for both selenium and stibnite. Sensibility curves for the same stibnite call for both equilibrium exposures, and exposures for ten seconds show a shift toward longer wave-lengths for the equilibrium exposures. Both selenium and stibnite show voltage effects. These results seem to indicate that the mechanism which brings about light sensitiveness in selenium and stibnite is of the same general character.—*Physical Review*, January, 1915.

Some Features of Resonance.—R. C. CLINKER.—In order to impress upon students the ideas of resonance and the phase changes which take place when a system passes through the resonant condition, the author uses a Frahm frequency meter (made up with reeds) which is viewed through a stroboscopic disk. An experiment is also described depending on high-frequency currents. —London *Electrician*, Jan. 29, 1915.

Ionometer.—An illustrated description of the "universal ionometer" of Siemens & Halske Company for measuring of intensity of ionization, etc.—*Zeit. f. Feinmechanik*, Jan. 5, 1915.

Roentgen Tubes.—An illustrated article on an automatic cooling arrangement for Roentgen ray tubes.—*Zeit. f. Feinmechanik*, Jan. 5, 1915.

Telegraphy, Telephony and Signals

Power-Circuit Interference with Telegraphs and Telephones.—S. C. BARTHOLOMEW.—The author discusses successively interference from electric light and power systems, from electric tramways and from electric railways with telegraphs and telephones, and gives details of the experience of various single-phase roads in different countries. Although much has been done to eliminate interference, yet a certain amount of trouble has been experienced on the Midland Railway, the London, Brighton & South Coast Railway and other lines. In the case of the London-Brighton line electromagnetic effects appear to have been reduced considerably by carefully connecting the distributer outer to the rails at intervals; nevertheless, a certain amount of interference was found, and it became necessary to divert some of the post office circuits. On the other hand, electrostatic effects do not seem to have given any trouble, possibly because of the earthed structures carrying the contact wires and to numerous earthed telegraph poles.—London *Electrician*, Jan. 29, 1915.

Balancing of Telephone Cables.—The conclusion of the long illustrated paper on the balancing of telephone cables which require to be loaded for superimposed working.—*Post Office Elec. Eng. Journal* (London), January, 1915.

Measuring Wave-Lengths.—F. A. KOLSTER.—A bulletin describing a new direct-reading instrument for measuring the logarithmic decrement and wave-length especially designed for the radio inspection service of the Bureau of Navigation, Department of Commerce, and also adopted by the War and Navy Departments.—*Scientific Papers*, Bureau of Standards, No. 235 (Aug. 15, 1915).

Exchange Design.—H. F. E. DEANE.—The conclusion of his very long illustrated paper on the traffic side of exchange design work. In the present instalment the author deals with junction and desk equipment.—*Post Office Elec. Eng. Journal* (London), January, 1915.

Resistance of Carbon Contacts in Telephone Trans-

mitters.—A. L. CLARK.—An article on experiments made with ordinary solid-back telephone transmitters. If a solid-back transmitter to whose front disk sufficient elastic freedom of motion is given is placed in an electrical circuit where the potential difference between its plates is a few volts, the resistance rises at first—in some cases as much as 100 per cent or more—and then falls off more slowly. The rapidity of the rise in the earlier part of the experiment, as well as the amount of rise, and later, the rapidity of the fall in resistance, depend on the current density through the apparatus, being greater for large currents than for small. These phenomena and some complications of the same were studied by the author and a partial explanation was given. However, the theory of the action of the transmitter is not yet complete. More than the area of contact must be taken into account to explain the changes in resistance. The action of the gas is certainly of importance.—*Physical Review*, January, 1915.

Electric Transmission of Pictures.—J. BLONDIN.—After giving a review of former methods of transmitting pictures electrically or "seeing by wire," the author discusses the method of Georges Rignoux. The arrangement is shown in Fig. 6. The transmitter consists of a series of selenium cells forming a surface on which the picture to be transmitted is projected. Each cell is connected to a relay which is regulated in such a fashion that when the cell is lighted an electromagnet attracts its armature, which then closes the secondary circuit. The secondary circuits contain a source of emf the positive pole of which is connected by a common wire to the upper terminals of the secondaries of the relays. Each lower terminal is connected to one segment of a circular commutator on which slides a brush connected to one of the line wires. The other line wire is connected to the negative pole of the source of emf. The two line wires are connected at the receiving station to a coil in the axle of which there is a tube filled with carbon tetrachloride, through which a bundle of polarized light passes. The source of light is an arc lamp with convergent electrodes placed below a mirror inclined at an angle of 45 deg. in a lantern, thus rendering the bundle of light horizontal. The light passes in succession through two lenses, a nicol, the carbon tetrachloride tube, a second nicol, two more lenses, and falls finally on revolving mirrors which reflect the spot of light on a screen. The disk on which the mirrors are mounted revolves in synchronism with the brush sliding on the commutator in the transmitting station, and the mirrors have slightly different inclinations so as to reflect the spot of light to successive adjoining points on the screen. Whenever in the transmitting station the brush on the commutator makes contact with a segment connected to an illuminated selenium cell, a current passes through the coil in the receiving station. When the brush makes contact with a segment connected to a selenium cell which is dark no current passes through the coil in the receiving station. The two nicols of the receiver are adjusted to light extinction in the latter case, and the rotation of the plane of polarization of the light under the influence of the magnetic field will let the light appear in the former case. At any moment the current in the coil depends on the degree of the illumination of the selenium cell to which the segment is connected with which the commutator brush makes contact at that instant. In the receiving station a picture will therefore be obtained on the screen which is similar to the picture projected in the receiving station upon the selenium cells, and if the speed of rotation of the commutator is quick enough the different successive light spots will give to the eye the impression of one simultaneous picture. Several improvements to be made are also discussed.—*La Revue Elec.*, "Oct. 16, 1914 (published Jan. 15, 1915)."

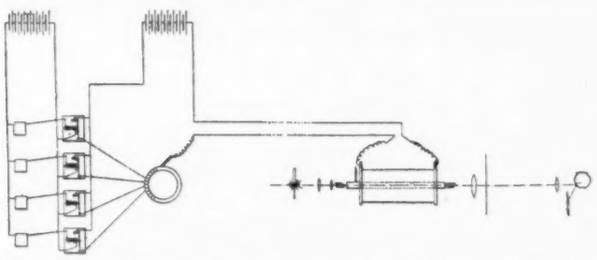


FIG. 6—APPARATUS FOR ELECTRIC TRANSMISSION OF PICTURES

Book Review

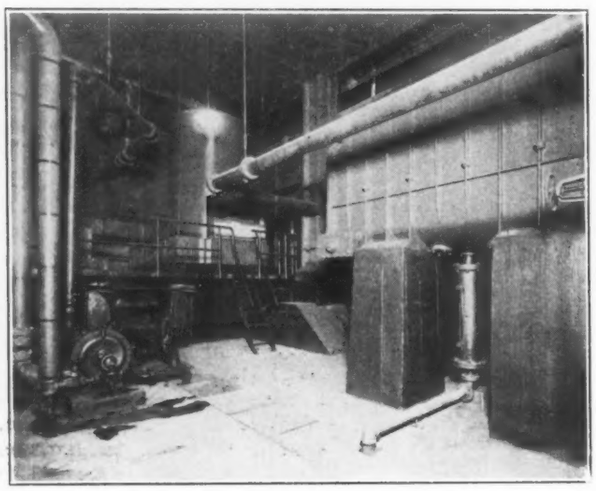
OPTIC PROJECTION. By Prof. Simon Henry Gage and Dr. Henry Phelps Gage. Ithaca, N. Y.: Comstock Publishing Company. 732 pages, 413 illus. Price, $3.

The authors are to be congratulated upon having produced in this volume an unusually fine piece of work in a direction where the work was needed. Optic projection apparatus, which has come into very extensive use, has to be operated by a large class of persons who have not, as a rule, received much technical education. The book is particularly applicable to this class. It gives a large amount of sound technical information in clear and simple language. The book is remarkable in several ways. First, it is written in the metric system, which is a very great simplification and advantage. This one characteristic should greatly increase the utility, advantage and sale of the book. For the benefit of persons unfamiliar with the system the metric numerical values are sometimes followed by a parenthetic rendering into English equivalents. Second, each chapter concludes with a summary, expressed in the form of "dos" and "do nots," which are always forceful. Third, the book combines a great deal of ophthalmic physiology with optical physics in a very entertaining manner. Fourth, although the authors have manifestly participated in the work of preparing the manuscript and illustrations, yet they have had the courage to indicate the particular chapters for which they are severally more particularly responsible—a rare acknowledgment. The volume includes fifteen chapters, relating respectively to the following subjects: Magic lantern with direct current; magic lantern with alternating current; magic lantern for use on house electric-lighting system; magic lantern with the limelight; magic lantern with a petroleum lamp, with gas, acetylene and alcohol lamps; magic lantern with sunlight heliostats; projection of images of opaque objects; preparation of lantern slides; the projection microscope; drawing and photography with projection apparatus; moving pictures; projection rooms and screens; electric currents and their measurements; arc lamps, wiring and control; candle-power of arc lamps for projection; optics of projection; uses of projection in physics; normal and defective vision. The book concludes with a historical review of the subject, a list of manufacturers and of the apparatus they manufacture, a good bibliography, and a copious index. The illustrations are abundant and good. The work combines sound theory with simple practice to an unusual degree. It will recommend itself to designers, makers, operators and readers of all optical projection apparatus from microscopes to "movies."

POWER AND OPERATING SECTION

Piping Permanently Installed for Conducting Tests

In most generating stations if any apparatus is to be tested considerable time has to be spent in laying out piping to connect the machine to be tested with the testing apparatus. In a large station the installation of the temporary equipment may cost several hundred dollars. At the generating station of the United Electric Light & Power Company, New York City, a steam-apparatus testing laboratory has been established in the basement of the building and a permanent system of piping installed so that any equipment employed in the steam end of the plant can be tested by making only



STEAM-APPARATUS-TESTING LABORATORY

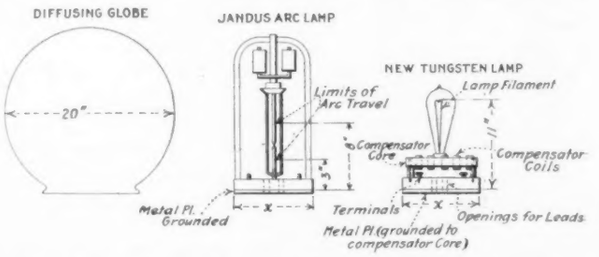
minor connections. In the laboratory are installed two water-weighing tanks, a surface condenser, an air bell and a hot-well pump. Circulating water is obtained from the fire line, which is continually under pressure. The water-weighing tanks can be discharged either into sewer drains or into tanks beneath the scales, to be pumped back into the hot-well discharge. The condenser is large enough to condense all steam exhausted from auxiliaries, but is not capable of handling that from the large turbines.

Replacing Boulevard Arc Standards with Nitrogen-Filled Tungsten Units

Three thousand of the inverted arc lamps which have lighted Chicago's North Side boulevards for several years are now being replaced by gas-filled tungsten lamps. As originally constructed the arc-lighting system consisted of inverted Jandus arc lamps inclosed in 20-in. diffusing globes and mounted on top of sightly concrete standards. Energy is supplied to the lamps through underground circuits.

To make the rehabilitation of the system simple, compensators with bases similar to those of the existing arc lamps were purchased. The coils of the compensators are mounted above these bases and the lamp sockets are set inside the coils. In making a change of lamps, therefore, it has been only necessary to disconnect the old arc lamp at its terminals, remove it, set the compensator in place, reconnect the leads to the new terminals, and place the tungsten lamp in the socket. Mr. Claude H. Shepherd, electrical engineer in charge of the reconstruction, expects to be able to change about fifty lamps a day with the men now employed in his department.

It was the practice with the arc lamps to extinguish those on one side of the street at midnight, but recently changes have been made in the circuit arrangements so

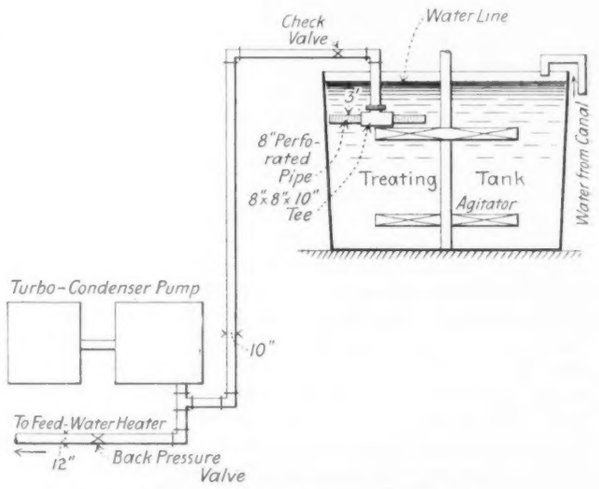


HOW CHANGE IS MADE FROM OLD TO NEW STREET-LIGHTING EQUIPMENT

that some of the lamps extinguished at midnight are on both sides of the street, the units which operate all night being staggered at regular intervals.

Increased Temperature Saves Two-thirds of the Water-Softening Chemicals

Economy in the use of chemicals for treating feed water and an increased feed-water temperature are two advantages gained by an exhaust-steam water-heating arrangement worked out at the plants of the Dayton (Ohio) Power & Light Company. Coming from the canal, the feed water for these plants needs to be treated with sulphate of iron, lime and soda ash, and with the system formerly used the water was treated at a temperature of approximately 60 deg. Fahr. But now a 10-in. pipe has been laid from the exhaust line of a turbo-condenser pump, which serves a 6000-kw



TREATING FEED WATER AT DAYTON

unit, to the treating tanks. This pipe line terminates in an 8-in. by 8-in. by 10-in. T, to the ends of which are fastened short sections of 8-in. pipe sealed at the ends, but perforated to allow the escape of steam. With exhaust steam supplied from the turbo-condenser pump the water can be easily brought to 150 deg. Fahr., and when water is treated at this temperature only about

one-third as much chemical compound is required as when treatment is attempted at 60 deg. Fahr.

Incidentally the temperature of the feed water to the boilers has been raised by the installation of this piping system. While water used to be delivered from the heaters to the boilers at 206 deg. Fahr., it is now delivered at 208 deg. Fahr. The men operating this system at Dayton report that it has always worked splendidly and that to keep it clean and in operating condition is an easy task. Flow-meter records show that the water rate on the turbine has not been increased by the addition of back pressure on the exhaust line of the turbo-condenser pump. Check valves have been installed at two points in the exhaust-steam line to prevent the possibility of water backing up into the small turbine.

Boiler-Room Practices in Europe and This Country

In building a generating station it is always desirable to keep the initial investment as low as possible in order that the overhead cost of doing business shall not prevent a reasonable return on the investment. In Europe it is practicable to build generating stations on about $75 per kw, as operations which have come to be performed by machinery in this country can be carried on in Europe much cheaper by human labor. Methods which can be used in this country, however, for minimizing investment and decreasing operating expenses were described by Mr. William A. Blonck recently in a lecture before the New York Electrical Society.

Among the practices which have become quite general in Europe is the use of moderately short stacks equipped with ejectors which will remove furnace gases at a rapid rate. The stacks are constricted at the roof where the ejectors are placed, and diverge slightly toward the outlet. One type of ejector consists of a nozzle surrounded by a movable sleeve, the position of which can be changed to regulate the gas velocity. The ejector is supplied with air from a motor-driven blower. In many cases the boilers are arranged in units, each being independent of the other and having its own breeching and chimney. This construction has been employed as it is considered more flexible. Only as many units as are required need be installed, therefore no equipment such as unused breeching and smokestacks is allowed to lie idle. As more equipment is required

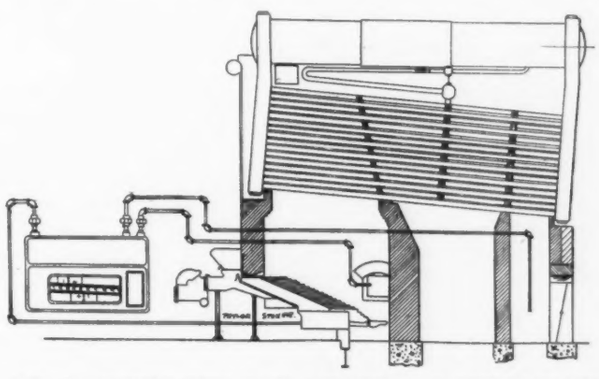


FIG. 1—DOUBLE-TUBE GAGE ATTACHED TO FORCED-DRAFT FURNACE

additional units can be installed without spoiling the symmetry of the station.

Another peculiarity of European stations is the use of small coal bunkers. The greater part of the coal is kept in outdoor storage space, from which it can be transferred to the overhead coal bunkers by traveling cranes and grab buckets. Where land is valuable outdoor storage of course is impracticable. Instead of trying to extract all of the heat from furnace gases while they are passing through the boiler flues, Europeans have quite extensively adopted the practice of installing economizers on each side or at the end of the boiler setting, to assist in generating steam and to reduce the temperature of the stack gases. The economizers are placed next to the boilers to prevent radiation from the setting. In many cases the economizers have about the same heating area as the boilers. The latter are usually constructed with only one pass to cut down the friction loss. Mr. Blonck declared that boilers of this type are capable of evaporating about 10 lb. of water from and at 212 deg. per sq. ft. of boiler surface with an efficiency of 70 per cent in the boiler alone or 85 per cent for the combined boiler superheater and economizer. The products of combustion leave the stacks at about 350 deg. Fahr. About twice the grate surface employed by American manufacturers is used in European boilers.

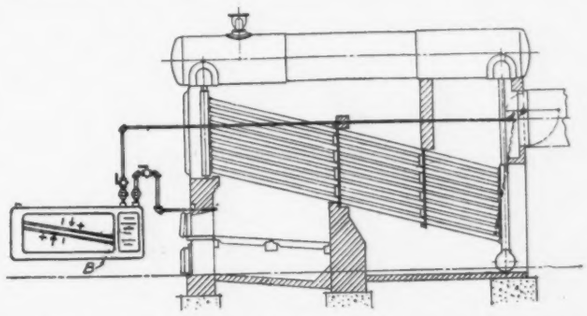


FIG. 2—DOUBLE-TUBE GAGE ATTACHED TO NATURAL-DRAFT FURNACE

In Europe chain grates have been equipped with louvers for cutting off the air supply to one-half the grate during light loads. Coal is burned over the front half of the grate and ashes are carried across the rear half, which receives no air from below. This arrangement eliminates the necessity of running a thin fire over the entire grate with the possibility of holes forming at several points allowing the majority of the air to pass through and chill the fire. In engine rooms the connection between the turbines and condensers is usually made through a water seal to provide an emergency relief for the exhaust steam in case the back pressure increases, and still prevent air leaking in. There appears to be a general tendency toward using one turbine for driving all the auxiliaries connected with each prime mover. Sometimes the exhaust from the auxiliary turbines is discharged into the middle stages of the prime movers or is used to preheat water supplied to the economizers to prevent their sweating.

A considerable part of Mr. Blonck's lecture was devoted to a discussion of the importance of rigid boiler-room supervision. He pointed out that considerable amounts of money are spent on instruments for the electrical end of the generating station, but very little attention is being paid to the operation of the boiler room, where the latent energy of the coal is converted into steam. In discussing this subject he referred to the advantages and disadvantages of steam-flow meters and carbon-dioxide recorders for indicating boiler performance. He said that there is a time lag in the records furnished by most carbon-dioxide recorders, sometimes as much as twenty minutes, which is too late for any correction. Attention was called to objections to offering firemen a bonus on the percentage of the carbon dioxide obtained from the smoke flues, as most of them have found that the percentage can be increased

by admitting excess air to the grate and allowing the boilers to loaf. In either case the ability of the boiler to produce steam is decreased. The proper method of obtaining the highest rating from the boiler with the highest efficiency is to maintain a uniform coal bed and a constant ratio between the air supplied and the coal fired.

The speaker described a double fluid-column gage which will indicate when the correct ratio is being maintained between the air and the coal. By the relative

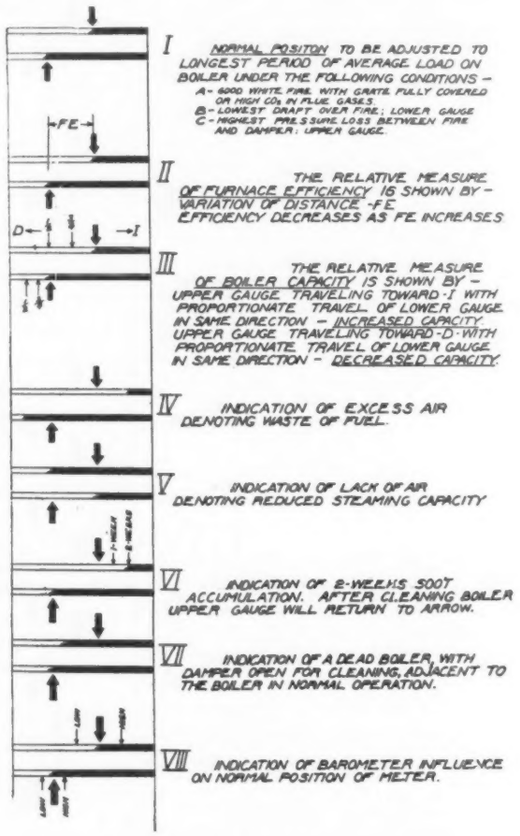

I
NORMAL POSITON TO BE ADJUSTED TO LONGEST PERIOD OF AVERAGE LOAD ON BOILER UNDER THE FOLLOWING CONDITIONS –
A – 6000 WHITE FIRE WITH GRATE FULLY COVERED OR HIGH CO_2 IN FLUE GASES
B – LOWEST DRAFT OVER FIRE; LOWER GAUGE
C – HIGHEST PRESSURE LOSS BETWEEN FIRE AND DAMPER; UPPER GAUGE.
FE
II
THE RELATIVE MEASURE OF FURNACE EFFICIENCY IS SHOWN BY – VARIATION OF DISTANCE – F E.
EFFICIENCY DECREASES AS FE INCREASES
D
I
III
THE RELATIVE MEASURE OF BOILER CAPACITY IS SHOWN BY – UPPER GAUGE TRAVELING TOWARD – I – WITH PROPORTIONATE TRAVEL OF LOWER GAUGE IN SAME DIRECTION – INCREASED CAPACITY.
UPPER GAUGE TRAVELING TOWARD – D – WITH PROPORTIONATE TRAVEL OF LOWER GAUGE IN SAME DIRECTION – DECREASED CAPACITY.
IV
INDICATION OF EXCESS AIR DENOTING WASTE OF FUEL.
V
INDICATION OF LACK OF AIR DENOTING REDUCED STEAMING CAPACITY
VI
INDICATION OF 2-WEEKS SOOT ACCUMULATION. AFTER CLEANING BOILER UPPER GAUGE WILL RETURN TO ARROW.
VII
INDICATION OF A DEAD BOILER, WITH DAMPER OPEN FOR CLEANING, ADJACENT TO THE BOILER IN NORMAL OPERATION.
VIII
INDICATION OF BAROMETER INFLUENCE ON NORMAL POSITION OF METER.

FIG. 3—MEANING OF GAGE INDICATIONS

heights of fluid in each column, it is possible to tell when a furnace must be fired, when additional air must be admitted, when boilers are overloaded or underloaded, when the holes occur in the coal bed, and when the tubes are covered with soot or the baffles are broken. The instrument has to be designed for each particular installation as its operation depends on the relative friction losses in the grate and in the boiler tubes. Curves taken from a recording instrument of this type contain fluctuations similar to those indicated by steam-flow meters and carbon-dioxide recorders used at the same time on the same equipment. A number of curves plotted from actual boiler performance were interpreted to show the uses of the device.

Discussion

Considerable interest was displayed by those present in methods of recording boiler performance. Among those taking part in the discussion were Messrs. C. O. Mailloux, R. J. S. Pigott and Frederick A. Scheffler. In contrast with the carbon-dioxide recorder referred to by Mr. Blonck and having a time lag of twenty minutes, Mr. Mailloux spoke of a device having a lag of only one and one-half minutes. He expressed the belief that it is the most practical instrument on the market for recording the percentage of carbon dioxide in flue gases. He pointed out, however, that the necessity for a record of the carbon dioxide in flue gases is not so important as was once believed. Where efforts are made to obtain high percentages of carbon dioxide other qualities such as steam-generating ability may be sacrificed. The speaker emphasized the importance of maintaining strict boiler-room supervision, as the greater part of the energy which is being converted into electricity is lost in the steam end of generating plants. He expressed the belief that some day indicating and recording instruments will be employed in the boiler room to as great an extent as they are used now in generating rooms, if not to a greater.

Mr. Pigott said that he was inclined to believe that it is better to spend money on boilers than on economizers. At the Seventy-fourth Street station of the Interborough Rapid Transit Company, New York City, boilers which were formerly capable of developing only 7500 kw have been altered so that they can be employed to furnish steam for a 30,000-kw unit which is being installed. Because of the enormous forcing ability of the gravity underfeed stokers, it is possible almost to quadruple the rating by removing the economizers and hence cutting down the friction opposed to flue gases. Although the boilers are thirteen years old, they are in good enough condition to permit an increase in steam pressure since the economizers are removed. Low stack temperature has been obtained even with the removal of the economizers as the underfeed stokers produce very short flames. As a result, all the combustible gases are burned before they strike the tubes of the boiler; therefore practically nothing but products of combustion pass up the chimney. The speaker expressed the belief that the shortness of the flame produced by a furnace is a measure of its efficiency, because long flames will be extinguished on striking the boiler tubes and will escape unburned unless ignited again. Of course, the path of the flame before it reaches the tubes can be made long enough so that only burned gases will pass through the flues. Mr. Pigott favors using steam auxiliaries in a generating plant to the extent where all of the exhaust steam can be utilized in heating feed water. He pointed out that a boiler-efficiency meter, whose operation is based on the relative frictions in the grate and tubes of a boiler, cannot be accurate under all conditions of firing as the ratio between these frictions changes. He added that an instrument can undoubtedly be constructed which will compensate for such variations. He also called attention to the fact that the amount to which a boiler can be forced depends to a great extent on the rate at which the flue gases can be removed.

Mr. Scheffler showed plans of the new generating station of the Elmira (N. Y.) Water, Light & Railroad Company and pointed out features of construction. At this station economizers are installed in the breeching. On a forcing test conducted at the station it was reported that one of the boilers was made to develop 275 per cent rated load with a temperature of 400 deg. Fahr. at the point where the gases leave the boilers and about 272 deg. Fahr. where they leave the stacks. The speaker declared that such equipment has developed 5.31 kw per boiler-hp.

Motor Drive in the Largest Flour Mill

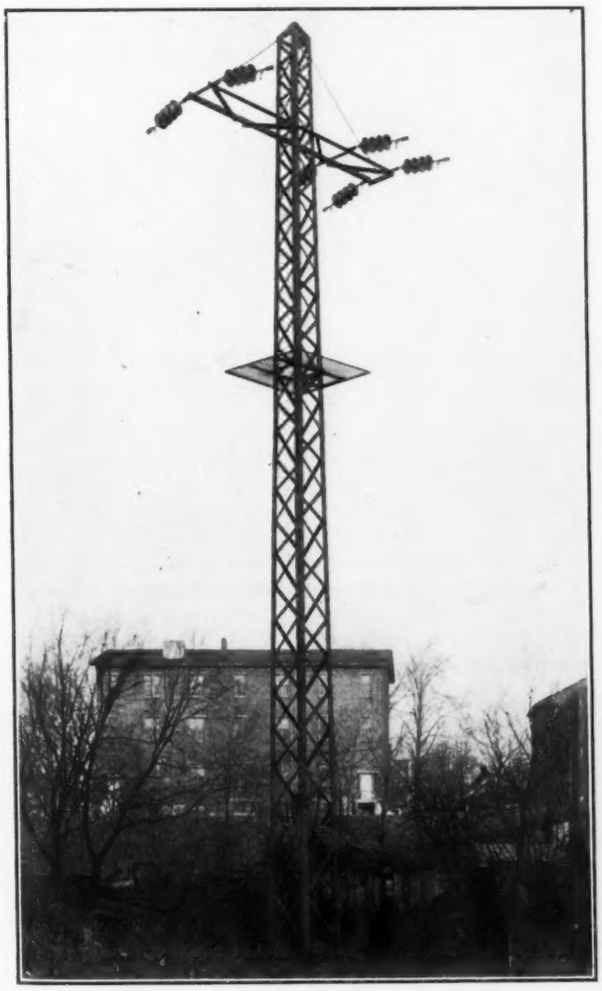
The Pillsbury "A" flour mill at Minneapolis, Minn., now has a total motor equipment aggregating 5580 hp, including a number of very large motor units. There are one 1500-hp motor and one 1000-hp unit, besides a number of smaller motors. This mill is operated from a steam-turbine plant with an equipment of 6250 hp in prime-mover units. In one day this mill, which is the largest in the world, turned out 16,125 barrels of flour.

Paint Stops Draft Leak in Boiler Settings

A coat of high-temperature, extra-heavy stack paint applied to the brick boiler settings in the plant of the Springfield (Ohio) Light, Heat & Power Company increased the natural draft through each furnace by 0.15 in. Mr. Weare Parsons, treasurer and manager of the Springfield company, conceived the idea of experimenting with stack paint on the boiler settings, and it was under his direction that the first trials of this draft-increasing idea were made at Springfield. Two men were placed at work on the side of a setting, and even as they worked it is said that an observer at the draft gage could detect the upward trend of the water column. When the painting of one setting had been finished the workmen began on another, and as the pores of the brick setting of each unit in the boiler room were sealed with paint approximately the same increase in draft reading was noted.

Tower Guards That Protect the Boys

About 17 miles southeast of Dayton, Ohio, lies the town of Xenia, which is receiving electric service over a 33,000-volt transmission line operated by the Dayton Power & Light Company. In Xenia square-base steel towers made by the Archbold-Brady Company have been used to carry the line, the Dayton company having added an interesting safety feature to prevent small boys from climbing up to the wires. The progress of an active climber up one of these poles is unimpeded until he reaches the horizontal platform, illustrated herewith, which is attached to the frame of the tower, about 25 ft. from the ground. Linemen and troublemen who must ascend these towers all carry master keys which will unlock trap-doors in the platforms. When unlocked these doors swing upward, allowing easy passage.

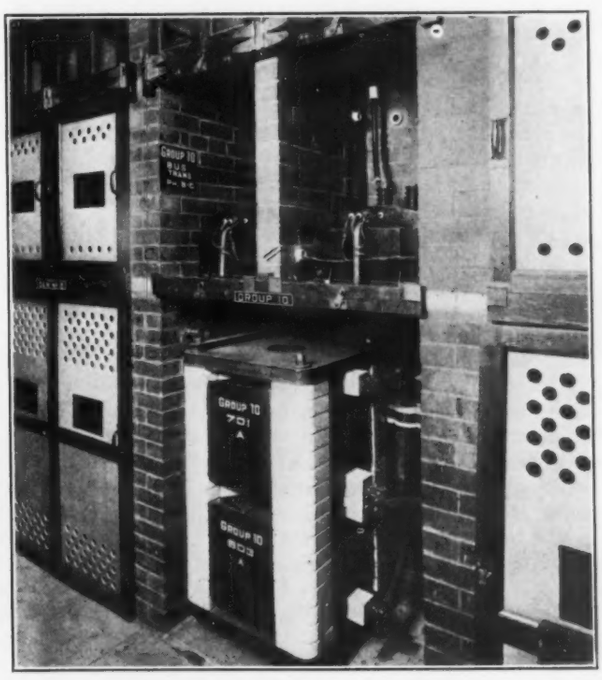


GUARD TO PREVENT AGILE BOYS REACHING WIRES

Oval signs made of metal and bearing the inscription "Danger! Keep Off! Dayton Power & Light Company," are also hung on the towers near the base. But poles standing in alleys and back yards where small boys congregate present an almost irresistible temptation, and when some daring but thoughtless youngster says to his chum, "I banter you to climb it," the chances are that the presence of so silent and seemingly inconsequential a thing as a danger sign will have considerably less effect than will the boy's notion of what the chum will think if he does not accept the challenge. The Dayton safety committee contends, therefore, that so long as American boys are the red-blooded, agile and somewhat thoughtless race that they are, absolute safety can be had only by making it a physical impossibility for the boys to reach the wires.

New York Company Employs Feeder Reactors

Feeder reactors are now being installed in the generating station of the United Electric Light & Power Company, New York City. They are being placed in compartments just below the potential transformers. Only two reactors are being employed in each three-phase circuit, however, as whatever current passes through one conductor will have to be returned through one or both of the other two. The units which have 3¼ per cent reactance are porcelain-clad and mounted vertically in pairs to economize in space. The current rating of the feeder cables is 300 amp. Besides these reactors there are also 18 per cent units connected between the bus sections, which are designed to carry 2000 amp. Further resistance to surges is offered by each generator's inherent reactance, which is about 7.5 to 8 per cent. The rated full-load current for each generator is 1387 amp per phase.



FEEDER REACTORS IN THREE-PHASE CIRCUIT

COMMERCIAL SECTION

Fair Play to All Contractors

New customers often inquire at the office of the electric-lighting company for the name of an electrical contractor who can be recommended by the company. If particular names are specified in reply, the rest of the contractors in town are likely to charge the company's employees with discrimination, while, on the other hand, if no information is given the customer departs dissatisfied.

To satisfy everybody the electrical department of the St. Paul Gas Light Company, St. Paul, Minn., has prepared a printed list, with addresses and telephone numbers, of the electrical contractors, electric-fixture dealers and electric-sign makers doing business in the city, and a copy of this list is handed to any caller asking about electrical work. The back cover of the miniature directory carries a message on the use of electric devices in the home.

Suggestions for Home Illumination

In a paper presented recently before the New York Section of the Illuminating Engineering Society by Mr. George W. Cassidy were described methods of illuminating various rooms in modern suburban homes costing from $5,000 to $15,000. In the entrance hall the intensity of illumination should be at least 1 ft.-candle to 1.5 ft-candles. Uniformity of illumination is not necessary, but there should be no dark corners.

Hall Fixtures

Assuming that the hall is finished in the colonial style and measures 16 ft. long by 10 ft. wide by 9 ft. 6 in. high, there should be one ceiling and two bracket or wall outlets. The ceiling outlet should be in the middle of the room and the side outlets arranged to balance properly. For economic reasons the ceiling outlet should be wired for two circuits, one for the night light and the other for general illumination. For convenience the lamps should be controlled from the second floor as well as from the first floor. To shield the brilliant filaments of the lamp the fixtures should be provided with artistically designed shades made of tinted diffusing glass, or amber-colored incandescent lamp bulbs may be used.

Living-Room Illumination

Living-rooms are generally used for several purposes; therefore the lighting scheme should be flexible. In addition to being the library of the home, this room is often used for festive occasions. There are other times when members of the family simply desire to sit around and converse. To meet these conditions it is advisable to supply at least three different lighting systems. In order to minimize the intrinsic brilliancy of the filaments, afford even distribution of light and reduce glare, there should be two ceiling outlets, one in the center of each half of the room. Each fixture may be wired with two circuits, one for high-candle-power lamps and the other for lower-intensity units. The higher-rated units should develop about 3.5 ft.-candles at the table tops, for card-playing, dancing and special occasions. For average conditions 1.5 ft.-candles intensity will be sufficient. The arrangement described is based on the assumption that the room has a light buff ceiling and medium brown walls trimmed with Flemish oak and measuring 24 ft. long by 18 ft. wide.

With a ceiling only 9 ft. 6 in. high it would be bad practice to employ semi-indirect or total-indirect fixtures as they cannot be suspended far enough below the ceiling to give even distribution of illumination thereon. With a room 11 ft. to 12 ft. high these fixtures could be used to advantage without producing objectionable bright spots on the ceiling. One or more table lamps or side brackets properly arranged will help produce the correct light distribution. Total indirect illumination is undesirable in the home as the opaque bowl offers too sharp a contrast with a lighted ceiling.

Types of Fixtures to Use in Living-Room

The most commonly used and preferable fixture for lighting this room is a direct-light type of the multiple-unit or shower design. Artistically tinted lamp shades may be employed to reduce the glare. Semi-direct fixtures are also desirable for living-room lighting. They can be provided with glass bowls equipped with opal covers and containing lamps arranged so that a large percentage of the rays pass through the lower side of

FIG. 1—SHOWER-DESIGN FIXTURE

the bowl and allowing only soft diffused light to be transmitted to the ceiling to prevent bright spots. Care must be taken in arranging the lamp within the bowl to prevent the filaments showing through the glass. Although the fixture just described would have hardly any physiological objections, it would be defective from the artistic and psychological viewpoint, on account of the lack of warm colors and the correct balance of light. While natural daylight is the ideal light in all manufacturing pursuits, office work, drafting and many other commercial enterprises, it is not so desirable for home illumination as the light containing the richer and warmer colors of the spectrum. Electric illuminants are rapidly approaching natural daylight and should therefore be modified for home illumination. Among materials suitable for producing color effects in decorative lighting are silk, gelatine and glass. Incandescent lamps are now being placed on the market with amber-colored bulbs. By employing yellow-tinted glass bowls and amber-glass lamps or ordinary lamps with color caps it is possible to obtain hospitable effects and bring out the real fineness of decorative schemes.

Table lamps are now being made which are artistic, efficient as reading lamps, and flexible in the amount of illumination which they will produce. By turning one switch it is possible to obtain indirect light by illuminating the whole ceiling with a soft amber glow. By turning the second switch two more lamps illuminate a silk shade which diffuses a soft light over a large area of the floor. With a third switch two other lamps which are utilized for reading purposes may be lighted. The direct light is diffused by an alabaster acid-etched glass which is slightly curved so as to be parallel to the filaments of the lamps.

Lighting of Music Room

Dance or music rooms measuring about 40 ft. long by 12 ft. wide, having medium-dark walls and light-buff ceilings, may be lighted similarly to the living-room.

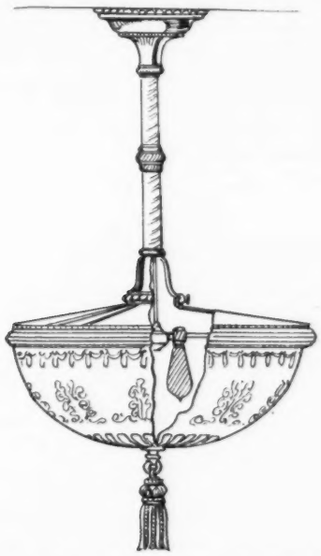


FIG. 2—SEMI-INDIRECT DINING-ROOM FIXTURE

If bracket fixtures are also used, they should be equipped with lamps of very low candle-power, requiring not over 10 watts. In selecting the light shields, whether of glass, silk or other fabrics, a low translucency is essential. If the room is used as a music hall, it is only necessary to increase the size of the illuminants in the indirect portion of the fixture to obtain the proper amount of illumination. If for economical reasons this is not practicable, the lighting scheme must be supplemented by a properly designed local fixture at the piano.

Dining-Room Fixtures

Dining-rooms may be lighted by a number of methods. Assuming that the room is about 18 ft. long and 15 ft. wide and has ivory-colored woodwork, medium straw-colored walls and light-buff ceilings, not so much energy will be required to illuminate the room as if darker walls and woodwork were employed. One desirable method of illuminating dining-rooms is to employ side-wall brackets with the lamps shielded. The fixtures may be supplemented by candelabra on the table. For the room assumed at least six two-lamp side brackets having lamps requiring not over 10 watts each should be used. All of these would have to be lighted, however, to prevent dark corners or unsymmetrical illumination; therefore this arrangement would be uneconomical in the moderate-priced residences.

Dome fixtures have the disadvantage of breaking the symmetry of a room, dwarfing everything around them, preventing artistic arrangement of floral decorations and producing too intense illuminations on the table by straining the eyes of those seated thereat. An amber-colored disk placed across the bottom of the dome will, of course, eliminate some of the psychological objections. Intense illumination can be prevented over the dining-room table by employing a semi-indirect fixture, as the bowl can be suspended only 5 ft. 6 in. from the floor. The indirect light can be softened by placing an amber-colored disk over the fixture. If the diffused lighting causes the ceiling to appear low, this defect can be eliminated by adding small lamps to the outside of the bowl. The glass should be tinted with a yellow tone and if silk is used amber and champagne color will be found preferable. Exposed lamps for direct-lighting units should not be rated at above 10 watts, but the lamps within the bowl may be rated as high as 60 watts. For economy it is advisable to have the lamps connected to two separate circuits.

Bedroom Illumination

Convenience and economy are the essential features to be considered in arranging the lamps in a bedroom. Satisfactory results have been obtained by placing one outlet in the center of the room and one over the dresser. The fixture in the middle of the room should be placed close to the ceiling and housed in an artistically etched

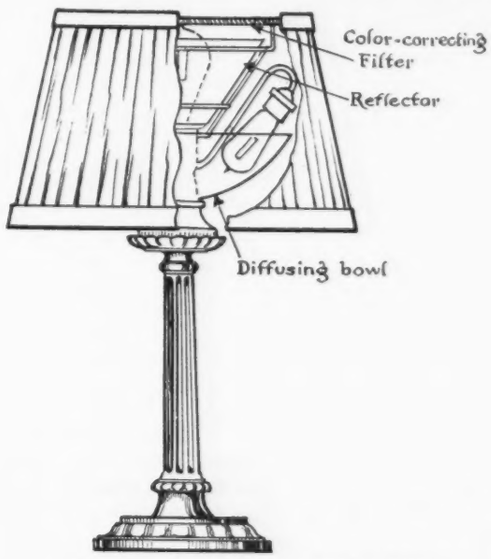


FIG. 3—LIVING-ROOM TABLE LAMP

and yellow-tinted distributing-type shade about 7 in. or 8 in. in diameter and with sufficient depth to cover the lamp filament. The interior of the shade should have a rough matte surface to diffuse the light properly. The dresser lamp should be suspended over the middle of the mirror and 10 in. to 12 in. in front. A height of 5 ft. 10 in. from the floor is about right for the fixture. What was said of the ceiling fixture also applies to the dresser lamp with the exception of the shade, which, if made of glass, should be tinted to eliminate glare. This is very important as the fixture is directly in the line of vision. A silk shade is preferable to a glass one for this reason as well as for the better artistic effect.

Kitchen and Bathroom Lighting

In kitchens, pantries, etc., fixtures should be placed close to the ceiling so as to be above the line of vision. The shades, preferably of opal glass, should be 7 in. or 8 in. in diameter and deep enough to conceal the lamp. If a wall lamp is required, it should be inclosed in a rather dense opal-glass shade also deep enough to conceal the filament.

Most bathrooms in moderate-priced houses are equipped with medicine closets having mirror doors

which can be used when shaving. In order that the mirror may serve to its best advantage, it should be in the shadow, while the person standing in front of it should receive the greatest flux of light. To obtain this result bracket outlets should be placed on each side of the closet and approximately 5 ft. 8 in. from the floor. The shades should be made of diffusing glass about 5 in. in diameter and deep enough to shield the light source. These lamps will also furnish the general illumination for the bathroom.

Denver's Electric Vehicle Salon

A central-station innovation was inaugurated by the Denver Gas & Electric Light Company from an idea conceived by Mr. Clare N. Stannard, secretary and commercial manager of that company. Mr. Stannard believed that much benefit could be derived by the company and its consumers who are interested in the electric-vehicle, battery, charging apparatus and accessory industries if an electric-vehicle salon could be held in the showroom of the Denver Gas & Electric Light Company. Accordingly, he requested the chairman of the Denver Section of the Electric Vehicle Association of America to announce his offer of the showroom for such a purpose and to extend his invitation.

The Denver Section unanimously accepted the opportunity to advance its interests and decided upon the week of Jan. 4 as a desirable time to hold the salon.

As a result of this idea, eleven 1915 model cars were exhibited in the central station's salesroom, and the end of the week found ten cars sold—eight passenger and two commercial—five of the passenger cars being of Detroit make. The exhibitors of charging apparatus were successful in placing five rectifiers in private garages and in selling some additional apparatus such as spark-battery rectifiers and electric tire vulcanizers.

The Denver Gas & Electric Light Company, in accordance with its usual custom, used every effort to bring this vehicle exhibit before the people who should be interested in the electric car. Full-page advertisements were placed in the New Year's editions of the Denver papers, and the succeding days found additional advertisements and news items. A thousand engraved invitations to visit the salon were mailed to desirable customers.

Nearly every one in attendance wondered how the cars were placed in the showroom. This was accomplished by removing a large plate-glass window on Sunday morning, runways being built from the street to the window sill and thence to the inside floor, and the cars were driven over the runway, through the opening and into the room. This operation was repeated when the cars were taken out of the building.

At the conclusion of the salon the exhibitors were profuse in their expression of appreciation for the opportunity given to them by the gas and electric company, and requested that it be made an annual event, promising that the number of cars in the next salon would be more than doubled.

Electric Cooking for Worcester (Mass.) Apartment House

In view of the success attained with all-electric cooking in a large apartment house on Irving Street, Worcester, Mass., built by the same concern, the Colonial Real Estate Company of that city will equip a new eighteen-suite apartment now under construction with electric ranges. As in the Irving Street property, no coal ranges will be provided and service will be supplied through a separate meter at a rate of from 3 cents to 4 cents per kw-hr. In the latter suites the monthly cost of energy for domestic cooking has averaged from $2.50 to $3 per family, three persons constituting the average household. The Colonial company is so much pleased with the results of electric cooking that all future buildings erected by it for apartment service will be provided with electric ranges exclusively.

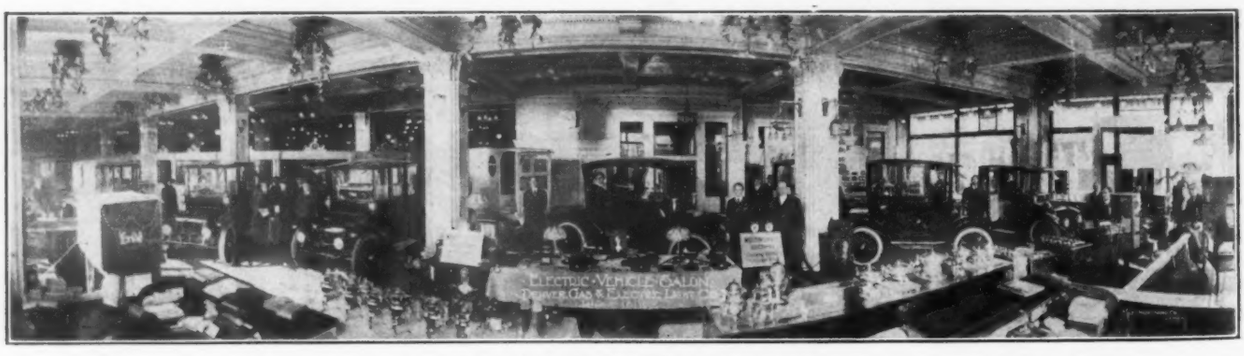
Electrical Organizations in Germany

BY J. W. WHITE, JR.

Until the present war stopped their activities Germany's electrical engineers and manufacturers could be counted on as competitors in any important electrical project in any part of the world. Their low prices and their promptness in getting a representative on the field were due to their highly efficient system of organization. Control of prices and output is among the most important activity of their societies.

The Association of German Electrical Engineers has 4000 members and was formed in 1893 to protect the interests of the German electrical industry. This organization is concerned principally with working out regulations for the electrical trade, claiming that little has been done along this line by legislative initiative. A series of standards has been introduced through the activities of this association, and the German government has always considered its recommendations.

The electrical manufacturers have an organization with a membership of 125 firms. It has succeeded in lowering import duties in many foreign countries having commercial treaties with Germany. It pays particular attention to exporters' complaints as to foreign tariffs. It publishes decisions of foreign customs officials regarding disputed classifications, collects foreign statistics, informs its members of foreign trade opportunities, and keeps in close touch with progress in electrical plants and railways in foreign countries.



DENVER'S ELECTRIC-VEHICLE SALON

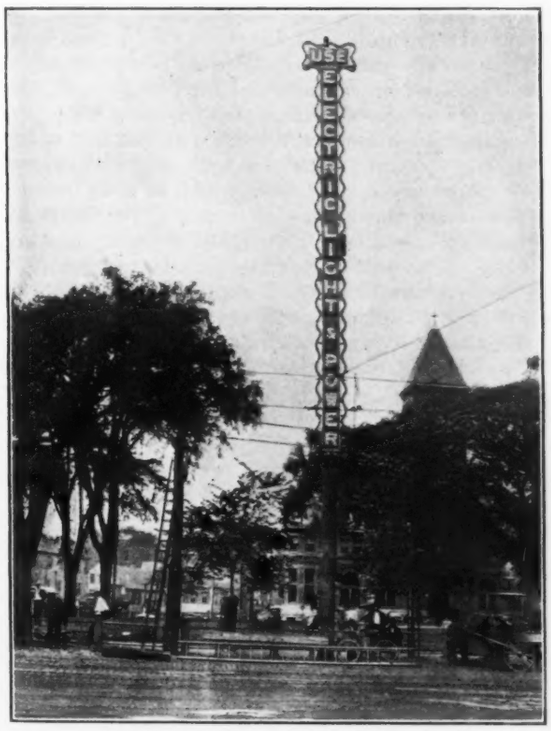
It suggests foreign representatives for its members and furnishes information to foreign inquirers.

This association maintains an arbitration court for settling the patent disputes of its members and advises members about their participation in foreign expositions. It has brought about a revision of German railway freight classifications on electrical supplies and has successfully combated the price-fixing syndicates of manufacturers of raw products. It maintains a publicity bureau which never fails to investigate press reports regarding short-circuits as causes of fires. This organization is an active member of several export promotion associations and has accomplished much of its export development by means of these connections. Manufacturers of electrical specialties have two organizations to combat price-fixing syndicates of the electrical manufacturers and to promote free competition in all goods supplied to users of electricity.

Other organizations allied to the electrical industry are the German Street Railway Association, the Association of German High-Current Cable Manufacturers, and the Association of Electrical Plants.

Noteworthy Electric Sign in Municipal Plant Service

The municipal electric-lighting department of Taunton, Mass., operates a striking illuminated sign at City Square and Main Streets, shown in the accompanying

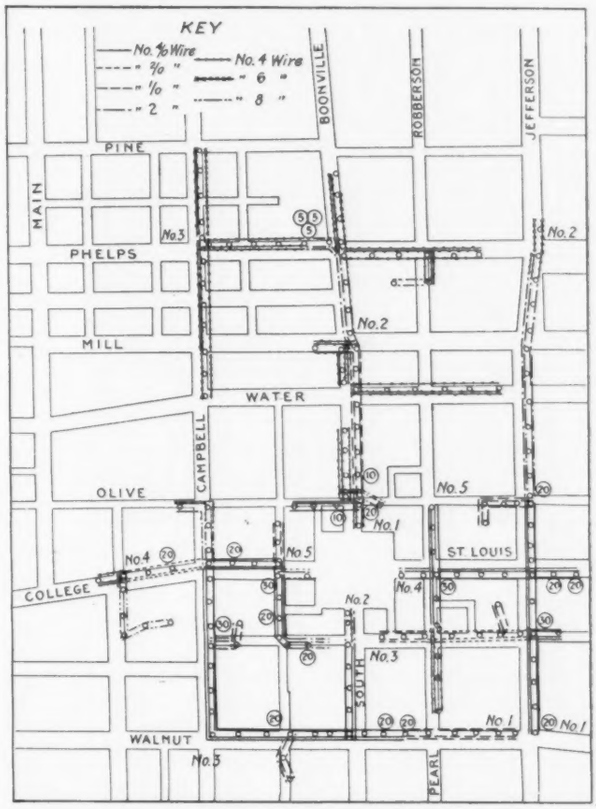


STRIKING SIGN AT TAUNTON, MASS.

illustration, the unique feature being the mounting of the letters on a frame 50 ft. long and 3 ft. wide, carried on a 75-ft. spliced chestnut pole. There are twelve 4-cp lamps in each letter, energy being supplied at 110 volts by a service run from an adjacent 15-kw transformer also supplying a bank customer. The border is composed of red and white lamps, and the sign is operated about 1800 hours per year. It was built by Betts & Betts, New York, and cost the town about $700. The border lamps are operated on a flasher circuit.

Solicitors' Data on Distributing Circuits

When a solicitor is sent out to work in a specified territory for the Springfield (Mo.) Gas & Electric Company he is provided with a neat map of his territory on which the company's lines are shown. Distributing circuits are drawn in seven colors to represent seven sizes of wire, ranging in size from No. 0000 to No. 8. Each pole is indicated by a small circle between the lines, and transformer positions are shown by larger



SECTION MAP OF LIGHTING SECONDARIES

circles, the kilowatt ratings of the transformer units being noted inside the circles. With this information in hand solicitors are well equipped to answer questions concerning line extensions, and they also can make estimates rapidly to determine whether additional copper or transformers will be necessary if a motor-service job is in prospect near the end of an existing line. In all cases the map is helpful to a man, however familiar he may be with his territory, for it gives him a definite layout of the low-potential circuits in streets and alleys and serves as a basis from which to work.

Special Offer Wires Sixty Houses a Week

By advertising a special twelve-dollar wiring offer the Kansas City (Mo.) Electric Light Company has been able to secure an average of sixty wiring contracts a week during the fall and early winter. In brief, the company's special wiring offer consists of an agreement to install one outlet with a two-way fixture in the kitchen or laundry of a home, equipping this fixture with a 60-watt lamp and a 6-lb. iron, all for $12. The payment of the $12 may be extended over a period of one year.

According to Mr. C. F. Farley, lighting contract agent for the company, more than 60 per cent of the calls from prospective customers, which at first were only inquiries for the special wiring offer, resulted in contracts for complete house wiring.

NEW APPARATUS AND APPLIANCES

Mantel-Type Radiator

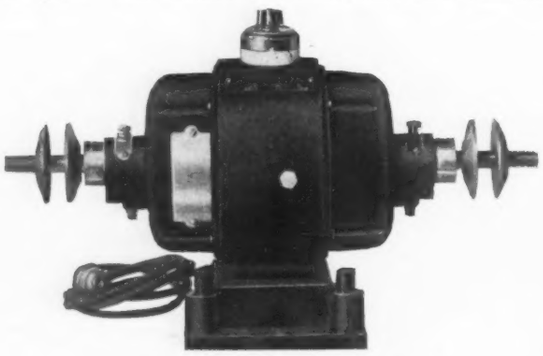
Several types of luminous radiators for use in an ordinary fireplace in the wall are being marketed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. These radiators range in size

THREE-UNIT ELECTRIC RADIATOR FOR WALL FIREPLACE

from 15.5 in. by 18 in. to 30 in. by 30 in. From two to four heating units are employed with each radiator and each heating unit takes 250 watts. Each radiator consists of an ornamental front, a polished-copper reflector and two, three or four heating units which are removable. The radiators may be finished in polished brass, antique brass, oxidized copper or polished nickel.

Electric Buffing and Polishing Machine

One of the new types of electric buffing and polishing machines recently placed on the market by the Atwater Electric Works, Coopersville, N. Y., is shown in the accompanying illustration. The machine shown is for large buffing and grinding wheels. It has oil-ring bearings and is rated at 0.5 hp for 3000 r.p.m. and 1 hp for 2000 r.p.m. The motors are dust-proof and removable

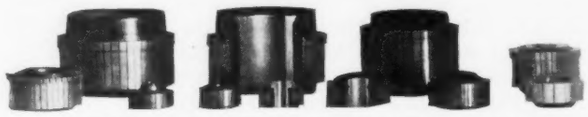


BUFFING AND GRINDING MOTOR

covers are provided for access to the commutators. Convenient switches are provided on the motors, no starting boxes being employed. When it is desired to use the machine for grinding, adjustable rests are employed to steady the work. A 1/6-hp motor running at 3000 r.p.m. is made for use by jewelers, silversmiths, etc.

Commutators with Molded Insulation

The accompanying illustrations show several types of recently developed commutators in which the insulation utilized is "bakelite." The bars of the commutator are of approximately the same shape as those employed with commutators using mica rings. Mica is placed between the bars, but the molded insulation is used to fill up all the space between the bars and the bushing, thus eliminating, it is claimed, all chance of short-circuits or

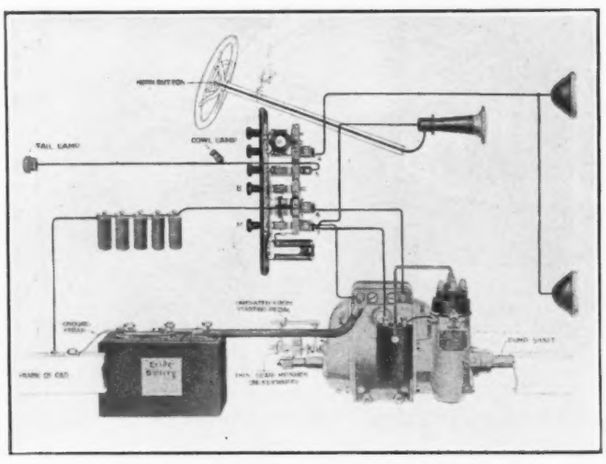


COMMUTATORS PROVIDED WITH MOLDED INSULATION

grounds. The commutators are being placed on the market by the Diehl Manufacturing Company, Elizabeth, N. J.

Starting and Lighting Outfit for Automobiles

The electric starting and lighting equipment for automobiles manufactured by the Dayton Engineering Laboratories Company, Dayton, Ohio, and designated as its 1915-model "Delco" outfit, embodies some improvements over apparatus placed on the market in previous years. The system includes a motor-generator which is mounted at the side of the engine and which is usually driven as a generator from the front end by means of an extension of the pump shaft. When the machine is operated as a motor, a starting pinion is thrown into mesh with teeth cut on the flywheel, and in this way cranks the engine. The energy generated is stored up in the battery, and, besides being employed to start the engine, is utilized for the lighting and ignition circuits. The ignition is automatically controlled, thus insuring a properly timed spark, the manufacturers declare, at all engine speeds. The ignition apparatus is made an integral part of the generator. The centrifugal force of a weight on the distributer shaft which controls the automatic spark advance also



AUTOMOBILE STARTING AND LIGHTING OUTFIT

controls the arm, which, sliding up and down on a resistance spool, automatically controls the output of the generator. The system includes a reserve ignition apparatus, a connection for horn and extra lamps, a dimming device for the head-lamps, a circuit-breaker and a locking device for both ignition and lighting circuits.

Therapeutic Lamp

A lamp which is provided with a conical reflector as shown herewith and a special carbon filament designed to generate a large amount of heat rather than a large amount of light has recently been placed on the market by the X-Radio Thermo Lamp Company, 1328 Broadway,

LAMP FOR CURATIVE PURPOSES

New York. The device is adapted particularly for curative purposes as a substitute for hot-water bags, poultices, etc. With the latter devices, it is declared, the parts of the body to which they are applied are heated by convection, but with the above lamp heat is transmitted by radiation and penetrates to various depths up to 2 in., thus acting as a stimulus to the tissues, it is claimed, in a way that is impossible with water bags or poultices. The lamp takes 200 watts, and it is equipped with a reflector 5.25 in. in diameter. The total length of the device is 8.5 in., and it is provided with a hardwood candle 5.5 in. long. The reflector is so designed that the light and heat rays are brought to a focus 2 in. from the edge of the reflector. The device is equipped with 9 ft. of extension cord and a plug so that it can be fitted in any ordinary lighting socket.

Three-Way Bus Support

The bus supports shown herewith are of the three-way type and were designed by the Electrical Engineers' Equipment Company, 711 Meridian Street, Chicago, Ill., for H. M. Byllesby & Company, for use by the Minneapolis General Electric Company, which the Byllesby company controls. Figs. 1 and 2 show a front and a side view of the support, and Fig. 3 illustrates how the supports are fitted into the bus structure. The support is designed for use with 3-in. by 1-in. busbars, the working potential of which is 17,000 volts. The

FIGS. 1 AND 2—THREE-WAY BUS SUPPORT

buses are mounted in a vertical plane, as shown in Fig. 3. The top and bottom supports are fastened to two parallel 1.5-in. pipes, which are 90 deg. apart. The middle support is fastened to one 1.5-in. pipe, and is bolted to and separated from the top and bottom supports by "transite" board. Each busbar is therefore in a separate compartment. The advantages claimed for this type of construction are low first cost, ease of installation, accessibility to buses and cool operation. With such an arrangement the building of concrete or brick bus structures is unnecessary. Before leaving the fac-

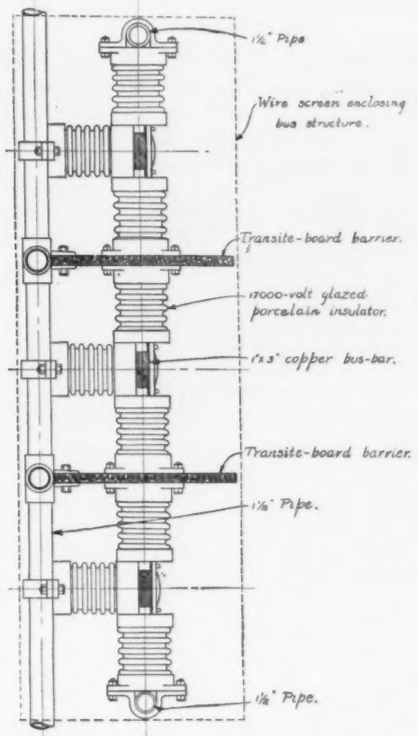
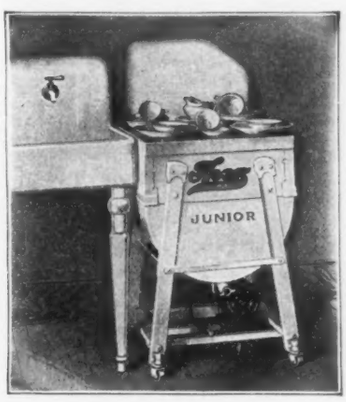


FIG. 3—METHOD OF INSTALLING THREE-WAY SUPPORTS

tory the three porcelain insulators of each support were subjected to a potential of 60,000 volts. The outer clamps of the support are of malleable iron, while those which support the energy-carrying parts are of composition metal. All the lamps are adjustable throughout 360 deg.

An Electric Washer for the Small Family

The "Thor Jr." electric washer and wringer has been brought out by the Hurley Machine Company, 35 South



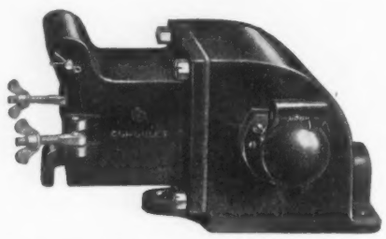
SMALL ELECTRIC WASHER USED AS KITCHEN TABLE

Clinton Street, Chicago, to meet the needs of the small family of two to four persons occupying a house, flat or apartment where space is limited. This miniature washer is attractively finished in white enamel and is

of the cylinder type, being similar in construction and material to the larger-size washing machines made by the same company. The wringer is equipped with a safety guard. When not in use the top of the washer may be used as an auxiliary kitchen table, as shown, the wringer being meanwhile inclosed in a cloth slip which protects the rolls.

Charging Receptacles for Surface Conduit Systems

A charging receptacle for horizontal or vertical mounting and for use with surface conduit systems is shown in the accompanying illustration. The part of the device containing the outlet can be attached to the



CHARGING RECEPTACLE FOR SURFACE CONDUIT SYSTEM

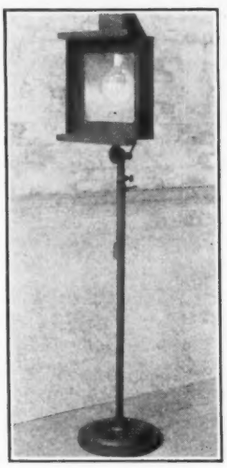
body, so that its spring door swings in the desired direction. A removable water-tight door can be furnished. The receptacle shown is provided with an auxiliary plug-receptacle attachment. These devices are manufactured by the Crouse-Hinds Company, Syracuse, N. Y.

Convertible Lighting Unit

A fixture which can be utilized for direct lighting, as shown in Fig. 1, or for semi-indirect or indirect lighting, as shown in Fig. 2, has recently been developed by the Dale Lighting Fixture Company, 107 West Thirteenth Street, New York City. In Fig. 3 is shown the fixture without the attachment for semi-indirect or indirect lighting. The ceiling plate is fastened to the outlet box with a lock-nut, and the cone shell is provided with keyholes to fit with holes in the ceiling plate. The device is equipped with a porcelain 660-watt receptacle and a detachable shade holder, as shown in Fig. 3, which is made in various sizes. The outlet wires connect directly to receptacle as shown and no splicing or insulating joints are required. The diameter at the top is 10 in. and the depth of the unit is 6 in. The fixture shown in Fig. 1 is equipped with a melilite reflector made by Gillinder & Sons, Inc., of Philadelphia, Pa. The fixture shown in Fig. 2 is equipped with a six-panel alabaster bowl. The fixture described above is called the "Broadway" lighting unit and was designed particularly for installation in the Equitable Building, New York.

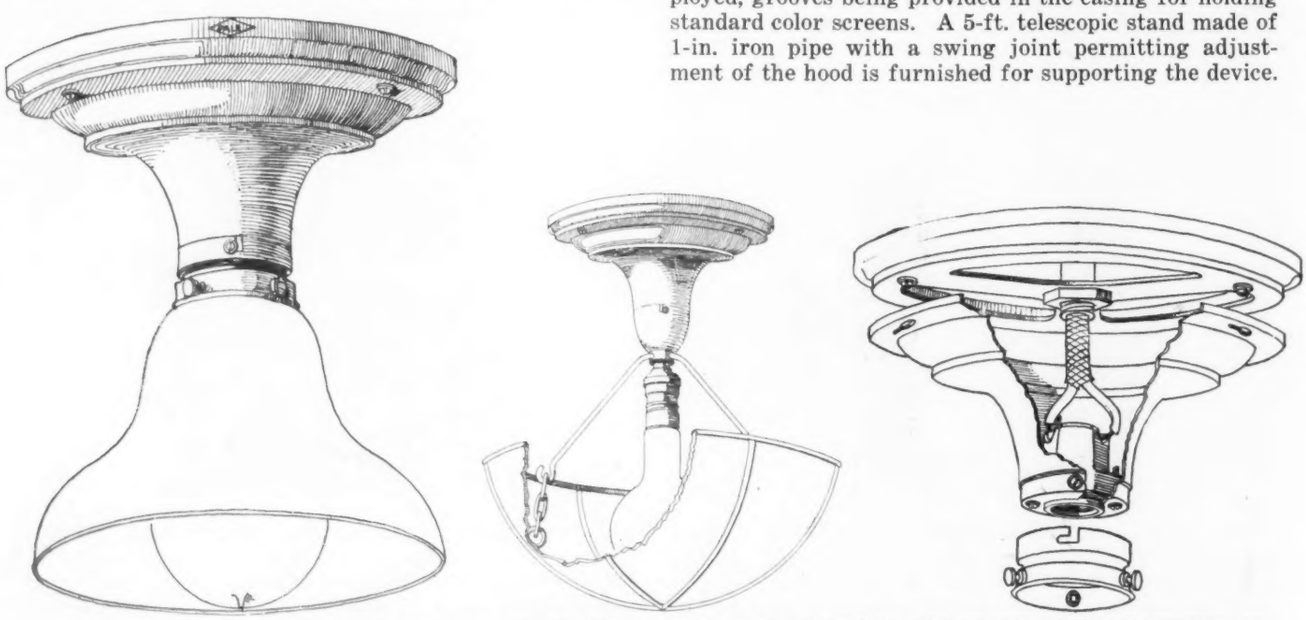
Stage Lamp

Herewith is shown a stage lamp employing a 1000-watt or a 750-watt gas-filled lamp which is designed to take the place of the hand-feed arc lamp commonly employed for the purpose and thus to remove the necessity for constant attendance. These lamps are known



INCANDESCENT STAGE LAMP

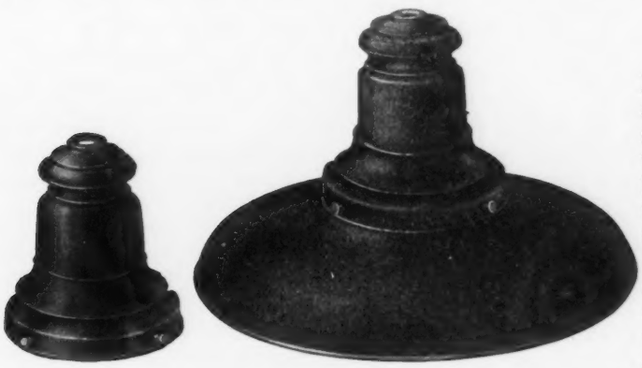
as the "Olivette" stage lamps and are manufactured by the Sprague Electric Works of the General Electric Company, New York City. An aluminum parabolic reflector inclosed in a suitable ventilating casing is employed, grooves being provided in the casing for holding standard color screens. A 5-ft. telescopic stand made of 1-in. iron pipe with a swing joint permitting adjustment of the hood is furnished for supporting the device.



FIGS. 1, 2 AND 3—FIXTURE ARRANGED FOR DIRECT AND SEMI-INDIRECT LIGHTING AND UNIT SHOWING METHOD OF ATTACHING SHADE HOLDER

Reflectors and Ventilated Hoods for Nitrogen-Filled Lamps

Several types of reflectors and hoods for high-efficiency incandescent lamps are being made by the Royal Enameling & Manufacturing Company, 326 West Madison Street, Chicago, Ill. The hood shown in Fig. 1 is



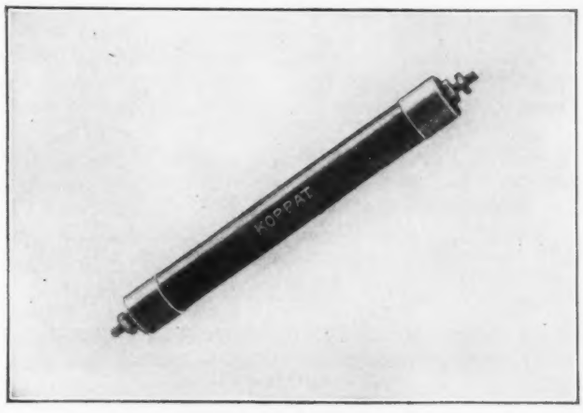
FIGS. 1 AND 2—HOOD AND BOWL-TYPE REFLECTOR ATTACHED TO HOOD

provided with a sleeve which extends down from the body 2 in. Underneath the upper portion of this sleeve are perforations 0.5 in. apart. Under the canopy on the top of the hood are ventilating holes. The cold air enters in the bottom perforations and forces out the hot air through the top. The hood is seamless and is porcelain-enameled. It is finished in black on the outside and white on the inside. The hood is so constructed that a globe can be used either with or without a reflector.

The illustration in Fig. 2 shows a bowl-type reflector attached to the hood.

Resistance Material

A vitreous material originally developed for use with the Burke horn-gap lightning arrester, which was described in the ELECTRICAL WORLD of Aug. 1, 1914, has recently been placed on the market by the Railway & Industrial Engineering Company, Greensburg, Pa. It can be molded into various shapes, and its electrical and physical properties, it is declared, are suitable for the



RESISTOR OF "KOPPAT"

requirements for which wire-wound resistance is now generally used. According to the manufacturers the material transmits energy uniformly throughout its mass, is strong mechanically, has a low-temperature coefficient of resistance and will not oxidize, nor is it subject to any chemical or other depreciation when subjected to severe climatic or atmospheric conditions. The material is adapted especially for use with switchboard rheostats, storage batteries, and as a resistor for use with arc head-lamps, etc.

Molded-Insulation Parts

As licensee of the General Bakelite Company, the Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, Ill., has recently designed a number of different devices of molded insulation. These devices are of an opaque bakelite and are black or reddish-brown in color. Fibrous fillers are mixed with the material to give it mechanical strength, to minimize the shrinkage in the molds and to reduce the cost of the product. Various compositions are used according to whether the particular property desired is resistance to high temperatures or resistance to acid or whether the strength, lightness, dielectric strength or appearance is of paramount importance. The Belden Manufacturing Company is also making sheets, rods and tubing of bakelite.

Radiator-Type Transformers for the New Haven System

The extension of the electric zone of the New York, New Haven & Hartford Railroad to the Harlem River terminal and to New Haven, resulting in an increase in load on the Cos Cob power station, has made it necessary to obtain additional energy. For economic reasons this energy is to be supplied by the United Electric Light & Power Company of New York City. An interesting departure in the type of the transforming apparatus is represented in the installation of Westinghouse radiator-type units, which will receive the power from the lines of the United Electric Light & Power Company.

In the original New Haven system power was generated at 11,000 volts, single-phase, and fed directly to the trolleys and feeders from the generator bus, with one terminal grounded. The first power house was situated at Cos Cob and supplied power for the electric zone extending 18.2 miles westward and four miles eastward of the tapping-in or supply point.

To take care of the above-mentioned extensions—namely, the Harlem River and the New Haven—it was proposed in the preliminary plan to build additional generating stations at some point on the Harlem River branch and at or near New Haven. The latter was to provide for the local traction requirements as well as for further trunk-line extensions eastward. Neither of these stations has been built, and in their place the present distribution system with 22,000 volts between the trolleys and the feeders was adopted with arrangements for the purchase of additional energy when it becomes necessary.

The change in the scheme of distribution involved no change in the generating equipment at Cos Cob, as the increased transmission voltage is obtained with auto-transformers stepping up the voltage from 11,000 to 22,000, with the mid-point grounded. The voltage stresses on the generator windings are actually less with this arrangement than with the straight grounded system for which the apparatus was originally designed.

The change in the distribution also required no additions to the existing overhead conductors, but only a rearrangement of connections to permit using the trol-

leys as one side of the 22,000-volt system and the feeders as the other. The mid-points of the balancing transformers which were installed along the system are grounded to the rail so that the potential of any conductor to ground is the same as with the original scheme; that is, 11,000 volts.

The new system of distribution has improved the voltage regulation of the system and has greatly lessened troubles due to inductive interferences which would otherwise have been increased with the increase in current due to the completion of service on the Harlem River branch and the New York, Westchester & Boston, also the extension of the New York division to New Haven. To meet the demand for the additional energy required, there are now being installed in the 201st Street station of the United Electric Light & Power Company two Westinghouse three-phase, twenty-five-cycle turbo-generators, each having a single-phase rating of 14,300 kva, and the necessary transformers and switching equipment. This energy will be fed into the New Haven system at West Farms, on the Harlem River branch.

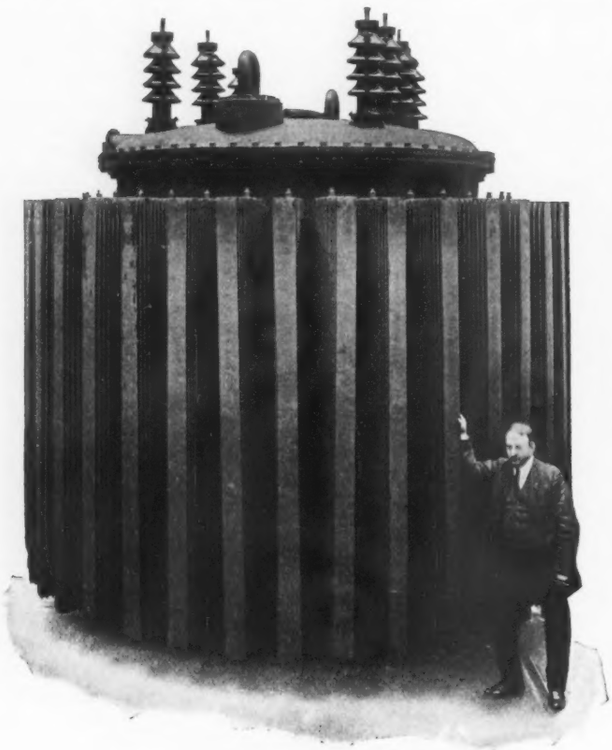


FIG. 1—RADIATOR-TYPE TRANSFORMER

From the point of view of the transformers, this installation of radiator-type units is of particular interest for several reasons. The main purpose of the installation is to supply the single-phase current for the railway load, but a smaller amount of three-phase current is also delivered to the West Farms substation for lighting and motor circuits.

The banks of the step-up transformers in the 201st Street station are each made up of a large unit rated at 5500 kva, connected in "T" with a smaller unit of 1000 kva rating as the "teaser." The primary side of the bank receives the energy at 6600 volts, three-phase. The secondary winding of the large transformer steps the voltage up to 24,600 volts, while the smaller transformer, or "teaser," steps it up to 12,300 volts. This gives an unsymmetrical three-phase transmission voltage having 24,600 volts across the principal phase and 17,400 volts across the other two phases.

The transformer banks at the West Farms substation are also made up of two units connected "T" to "T," the main unit being of 5000-kva rating and the "teaser" of 1000 kva. The primary windings receive the unsymmetrical three-phase voltages at a lower value than at the raising transformers on account of the line drop. The secondaries are wound to give 23,000 volts across the main phase and a balanced three-phase voltage of 11,000 from the "teaser" transformer and taps installed in the secondary winding of the 5000-kva unit. To take care of the fluctuations of the railway load, both the raising and lowering transformers will carry 150 per cent of full load for one hour, 200 per cent for seven minutes, or 250 per cent for one minute. The latter represents an output of 13,750 kva for each of the large air-blast units and 12,500 kva for each of the large radiator-type units.

The step-up transformers in the 201st Street station are of the air-blast type. The 5500-kva units are by far the largest transformers of this type that have so far been built. The output of each unit is probably three times as large as the largest single-phase air-blast transformers of the same frequency now in operation. Both the "main" and the "teaser" transformers are built in the Westinghouse company's new form with housings of structural iron and sheet steel. This form of construction replaces the bulky and cumbersome cast housings formerly used with air-blast transformers. The 5500-kva units take up very little more floor space than units of one-half the size, if built with the usual cast-iron housings.

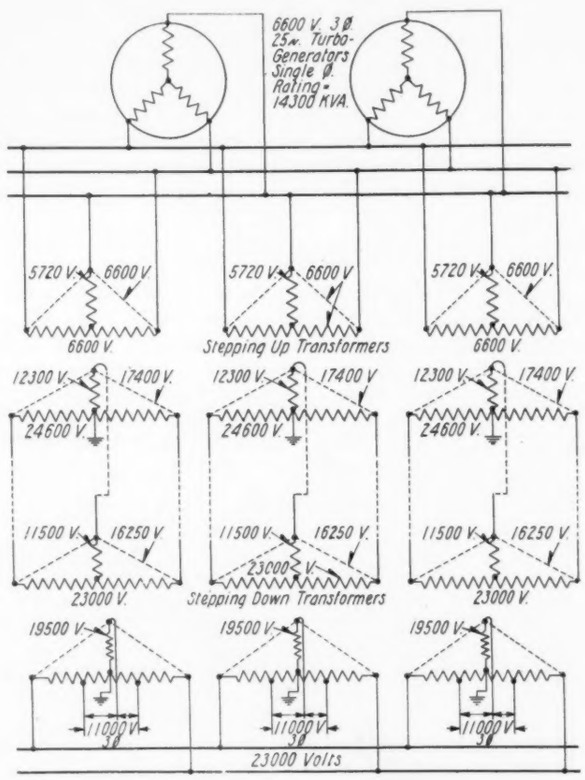


FIG. 2—DIAGRAM SHOWING METHOD OF CONNECTING TRANSFORMERS AND TURBO-GENERATORS

The 5000-kva transformers at West Farms are of special interest because they are the largest transformers so far built without recourse to either an air-blast or circulating water for cooling purposes. They are of the radiator type, which makes possible a considerable increase in the size of such transformers with

economical costs. The largest self-cooled transformers now in operation on twenty-five cycles have a rating of 3000 kva, so that these transformers represent an increase in output of 67 per cent over the present largest units.

These transformers are cooled by a natural circulation of oil. The oil in contact with the windings and core, where warmed by the heat developed in the transformer, rises through the ducts between coils and along the surfaces of the core. In the upper level of the tank and radiators the oil is, therefore, much warmer than the outside surrounding air. Through the large radiating surfaces of the radiators this warm oil is cooled and descends to the bottom of the radiator and back into the tank, whence it rises again through the numerous ducts in the transformer windings. The path of the oil circulation is indicated by the arrows in Fig. 3. The vertical position of the radiators on the tank conforms with the natural path of the oil as it cools and also to the natural path of the cooling air which flows upward over the external surface of the radiators, and this has an important bearing on the efficiency of cooling.

The circulation of the oil is caused by the "thermal

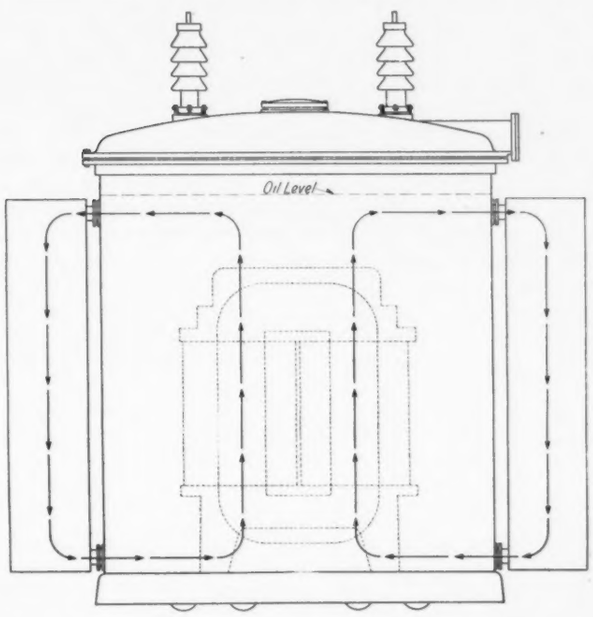


FIG. 3—DIAGRAM SHOWING PATH OF OIL CIRCULATION

head" or difference of temperature between the oil at the top and bottom of the radiators. The vertical radiators extend from the upper surface of the heated oil to the coolest oil at the bottom of the tank. The cooling system therefore represents a high efficiency in utilizing the maximum thermal head without increasing the temperature of the oil at the upper level, under which conditions the transformer would naturally operate at a higher temperature. Any restriction of area or unnecessary turns and bends tending to impede the flow of oil requires more difference of temperature between the upper and lower oil levels to circulate the required amount of oil. For this reason each radiator has its own connections to the tank at top and bottom, and these connections are made of generous size. The 2000-kva auto-transformers which are placed at intervals along the New Haven line are of the "tubular" type of tank originated by the Westinghouse company, wherein the oil is circulated by means of the cooling obtained in external tubes connecting the top and the bottom oil levels. While this is a very efficient type of tank, the limitations of size imposed by railway clearances restrict transformers of this construction to an output very much less than that necessary to meet the demands of this extension of the New Haven railroad system.

The new radiator type of tank, which is the result of extensive experimental work and tests on the part of the Westinghouse engineers, is a logical evolution from the tubular type. It has not only extended the upper limit of output considerably but has done so with an economy which justifies the use of such large units.

Portable Electric Tool

A device consisting of a revolving tool-bit socket which is connected by means of a flexible shaft to a motor mounted on an iron base set on swivel casters is being made by the United Manufacturing Company, Kansas City, Mo. It is adapted particularly to drilling,

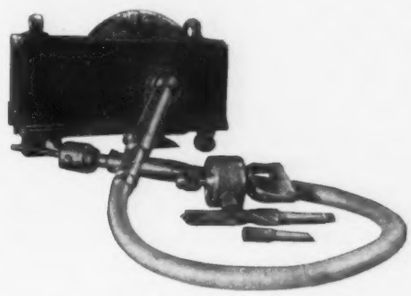


FIG. 1—VARIABLE-SPEED ELECTRIC TOOL

grinding, buffing, polishing, etc. Motors with ratings of 0.25 hp, 0.5 hp and 1 hp are used to operate the device. With the 0.25-hp motor and the 0.5-hp motor the flexible shaft is 7 ft. $\frac{3}{8}$ in. long. With the 1-hp motor and also the 0.5 hp motor, a flexible shaft 7 ft. $\frac{5}{8}$ in. is employed. The motor and all mechanical parts are inclosed in a metal housing as shown in Fig. 1. Handles attached to the housing make it easy to carry the machine. For obtaining variable speeds friction

FIG. 2—TOOL USED TO CLEAN AMMONIA-CONDENSING PIPES

disks are provided, and use is made of an adjustment screw to regulate the contact between the friction disks. Split couplings connect the flexible shaft and motor to the friction disks. Fig. 2 shows the apparatus in use for removing scale and corrosion from ammonia-condensing pipes in the plant of the Franklin Ice Cream Company, Kansas City, Mo.

CURRENT NEWS SECTION

Midwinter Convention of A. I. E. E.

The third midwinter convention of the American Institute of Electrical Engineers was held at New York City on Feb. 17 to 19 inclusive. President Paul M. Lincoln in opening the session gave his conceptions of an ideal engineering society, pointing to a round-table study by college students as the simplest form, and called attention to the fact that the value of an idea is negligible if it is hoarded and not divulged. Since knowledge increases with exchange of ideas, the president urged members to continue to bring their best ideas before the Institute.

Three sessions were held, at which the following papers were presented: "The Characteristics of Electric Motors," by Mr. D. B. Rushmore; "Effect of Moisture in the Earth on Temperature of Underground Cables," by Mr. L. E. Imlay; "Oil Circuit-Breakers," by Mr. K. C. Randall; "Comparison of Calculated and Measured Corona-Loss Curves," by Mr. F. W. Peek, Jr.; "A 100,000-Volt Portable Substation," by Messrs. Charles I. Burkholder and Nicholas Stahl; "Distortion of Alternating-Current Wave-Form Caused by Cyclic Variation in Resistance," by Messrs. Frederick Bedell and E. C. Mayer; "Dimmers for Tungsten Lamps," by Mr. Alfred E. Waller; "Searchlights," by Mr. C. S. McDowell; "Electrical-Precipitation Theory of the Removal of Suspended Matter from Fluids," by Mr. W. W. Strong; "Theoretical and Experimental Considerations of Electrical Precipitation," by Mr. A. F. Nesbit; "Practical Applications of Electrical Precipitation," by Mr. Linn Bradley, and "Electrical Porcelain," by Mr. E. E. F. Creighton. Discussions on the first subject were presented as papers.

At the meeting on Wednesday evening, an account of which is given elsewhere in the paper, several prominent engineers presented papers on "The Status of the Engineer." On the following afternoon trips of inspection were made to places of engineering interest. In the evening a dinner-dance was enjoyed at the Hotel Astor.

National Electrical Week Discussed by Development Society Directors

At a meeting of the directors of the Society for Electrical Development held in New York on Feb. 17 the principal matter under discussion was the plan for a "national electrical week." The board unanimously approved the plans of the committee, which were reported in the ELECTRICAL WORLD of Jan. 16, 1915. It was decided to go ahead with the plans for a national electrical week. The best date for the week was not decided definitely, but the majority of those present were in favor of a time early in the spring of 1916. It was felt that this time would give manufacturers of all kinds of electrical devices a better opportunity to reap substantial benefit, and it was recognized that a year's hard, earnest work will be required to perfect and carry out the plans necessary for an event so important and so far-reaching in effect. The matter was referred to a committee of five to be appointed by the president.

The reports of the general manager and the treasurer showed the society to be in a very satisfactory financial condition and that a very small percentage of the membership have resigned while a large number of members have already paid their subscriptions for the first half of 1915. The directors expressed their satisfaction with the work of the society, the way it had been carried on and the outlook for the ensuing year.

The matter of employing a resident representative on the Pacific Coast was discussed and referred to the president and general manager with power to act.

Mr. James Smieton, Jr., who has been acting as secretary-treasurer for the past year, was formally appointed to that office.

The annual meeting of the society will be held in New York on May 11.

Status of the Engineer

The "Status of the Engineer" was the subject of a symposium at the session of the third midwinter convention of the American Institute of Electrical Engineers on the evening of Feb. 17 in New York. The speakers were Messrs. L. B. Stillwell, E. W. Rice, Jr., E. M. Herr, Alexander C. Humphreys, George F. Swain, H. G. Stott and J. J. Carty.

Mr. Stillwell outlined particularly what the engineering societies can do to improve the reputation of the engineer, particularly by selecting and grading members more carefully. They can also enforce codes of ethics, expelling members for violation. Joint committees of engineering societies might also reach a decision for or against the licensing of engineers and thus remove the present uncertainty as to the opinion of engineers. Societies can also assist in improving the status of the engineer by furnishing information to legislative bodies regarding broad economic policies.

Mr. Rice pointed out that honesty is a habit with the engineer, necessarily so because his work must stand the test of experience. He pointed out a new field for the engineer in politics. The House of Representatives and the United States Senate are made up largely of lawyers, 65 per cent in the former and 75 per cent in the latter, while there is only one engineer in both houses. The engineering fraternity should be represented not only in an advisory capacity but also in an administrative one.

Mr. Herr showed that engineering and the engineer must stand for progress and improvement. An important field is the commercial one. The handling of men is a leading part of the work of the engineer. Mathematics, which is important in the engineer's training, unfits him for solving human problems. He must apply himself to these human problems, and in doing so the reaction upon him will be favorable.

Dr. Humphreys explained why a recommendation of Mr. Stillwell that engineers should have more liberal culture in their education is not practicable, at least to the extent desired by Mr. Stillwell. The sooner a young man gets the fundamentals of engineering and graduates into the school of experience the quicker will he become a real engineer. He should, of course, have more than the mathematics and science of engineering, but life is too short to study in college all that might be desired. Dr. Humphreys dwelt upon engineers as public service commissioners. While he did not advocate commissions made up exclusively of engineers, he thought they should have adequate representation.

Professor Swain showed that the engineer is recognized to the extent that he deserves. In analyzing the engineer as a leader, he pointed out that this depends upon knowledge and personal qualities, of which the latter are more important. If the engineer does not lead, it is largely because he lacks the necessary personal qualities. Engineers are paid and recognized adequately as compared with other professional men. Engineering training as given does not attract the best type of men and it has a tendency to narrow the outlook of those who take it. A remedy is to induce more able men to embrace the profession by pointing out its possibilities. Technical education should provide broader training and give skill in English. The engineer should somehow receive a broader outlook upon engineering problems, as the great questions of the day are not mathematical but social.

Mr. Stott made a plea for the government engineer, who does not receive proper recognition. Great public works performed under government supervision are due to engineers who are not paid adequately and receive little fame for their endeavors. Engineers must necessarily be divided into those who specialize and whose reward is in achievement in one or two lines and those who generalize and pass gradually from engineering to administrative lines. He instanced two of the other speakers, Messrs. Herr and Rice, as notable examples of the second class. He gave definitions of the engineer, one composed many years ago by Tredgold and the other his own revision, the difference being that Mr. Stott emphasized the human element.

Mr. Carty showed that the engineer designs machinery to produce results at an ultimate cost lower than is possible otherwise. A labor-saving machine is really a labor-making machine unless it produces this result, for, while it may transfer the labor to remote parts of the economic system, the labor is there just the same.

President P. M. Lincoln of the Institute, who presided, called attention to the fact that the contributors to the discussion represented the employers of the engineer, the makers of the engineer and the engineer himself.

Frank Smith Feted by Electric-Vehicle Men

In appreciation of the tremendous amount of work he accomplished while president of the Electric Vehicle Association of America, the officers and directors of that body tendered a dinner Monday evening to Mr. Frank Smith, past-president of the organization. The affair was held at Delmonico's in New York City and came as a genuine surprise to Mr. Smith, who, under the impression that he was keeping a dinner engagement with Mr. H. M. Edwards, of the New York Edison Company, was ushered into a room where he was greeted by electric-vehicle men from Chicago, Philadelphia, New York and Boston.

During the course of the dinner "charging songs of the Smith garage" were freely sung by the party, and the parodies caused no little merriment. After coffee was served an address was made by Mr. John F. Gilchrist, of the Commonwealth Edison Company of Chicago and president of the association, who spoke in very high terms of the work performed for the association by his predecessor, Mr. Smith. During the address, part of which was given to wit and good humor, a series of lantern slides illustrating Mr. Smith at different stages of his life were flashed on the screen.

Mr. Smith in his response told how greatly he was surprised by the dinner and how much he appreciated the sentiment of friendship which prompted it. What he had done for the Electric Vehicle Association of America, he said, was not so much as the electric-vehicle movement merited, and throughout his term his wish was for the necessary ability to bring to fruition his dreams of the possibilities of the electric vehicle as he saw them. Mr. Smith voiced his firm belief in the excellence of the electric vehicle and in its ultimate triumph. Before taking his seat he was handed a letter from Mr. Edison in which the inventor complimented Mr. Smith for his great work while president of the association.

Two serious speeches were delivered during the evening, one by Mr. James H. McGraw, of the McGraw Publishing Company, and the other by Mr. John W. Lieb, of the New York Edison Company. Both of the speakers in their prefatory remarks paid high tributes to the guest of the evening, not only for what he had done for the cause, but also as a man. In fact, the entire assemblage was unstinted in its expressions of fellowship and appreciation.

Mr. McGraw spoke of the possibilities of the electric vehicle for the transportation of city freight and what a great opportunity this afforded the central-station industry in increasing its revenues immensely—$200,000,000 per annum—from the sale of energy for battery charging. This, he claimed, was the most promising field for the commercial development of central-station business in sight. Mr. McGraw dwelt at length on the accomplishments of electricity and how it had worked wonders in every walk of life—in lighting, in industrial activities, in urban and interurban railway work, in trunk-line railroad electrification, in telegraphy, telephony and wireless communication. In the minds of the public electricity has worked not only wonders but miracles, because it has made possible conditions never dreamed of. This same confidence and admiration of things electrical should also be merited by the vehicle, and will be, the speaker said, if the central stations awake to their opportunities and proper publicity is given the vehicle. He intimated that $150,000 ought to be available for that purpose.

Mr. Lieb told of the uses made by the central stations of electric vehicles and how at first their employment for much of the work could not be justified entirely on the score of economy, although the vehicles possessed advertising merit. The charging of batteries without doubt, he said, made an ideal load for central stations in that by its very nature charging was a long-hour load, and what is more important, an off-peak load, thus justifying not only preferential rates but encouragement on the part of central-station companies as well.

The entertainment features concluding the dinner comprised motion pictures, cartoons of prominent electric-vehicle men and vaudeville sketches.

The Ship-Purchase Bill and Public Ownership

The bill desired by the administration providing for government ownership and operation of merchant ships was passed by the House of Representatives at 1:20 a. m. on Feb. 17. The House had been in session from 11 a. m. on Feb. 16. In discussing the report that the question of public ownership is really the most important one involved in the ship-purchase bill, a Washington correspondent of the ELECTRICAL WORLD writes:

"It has been whispered in Washington for some time that the real struggle behind the fight on the ship-purchase bill is based on the question of government ownership. Representative Martin Dies of Texas made that outspoken declaration on the floor of the House during the last week.

"Mr. Lewis defended President Wilson's course and declared that government ownership must come, in ships as well as railroads and other utilities. Representative

Dies declared himself ready to quit the Democratic party if 'the party is forced upon the Dead Sea of socialism and government ownership.'

" 'Once we embark the government,' Mr. Dies said, 'upon socialism and government ownership there is no turning back. When the government owns a railroad or these other great facilities it will either make a horrible, ghastly failure of government ownership or you will have to change the form of government under which we live.'

"The insistence of the administration upon the bill has caused the blockading of all other legislation. Speaker Clark declares that the question of whether an extra session will be called is 'a seven-to-one shot.' It is evident that it will be necessary to have one because the appropriation bills have not been passed."

The Place of the Engineer in the Defense of the Nation

Formulation of a definite plan for co-operation between members of the Western Society of Engineers and the Engineers' Corps of the United States Army in providing for the national defense was urged in a resolution adopted by the society at a meeting held Feb. 15 at Chicago.

The present European conflict has clearly shown itself to be war by the engineer and his instruments of destruction, points out the report. With our present standing army little more than a nucleus around which to assemble the volunteer forces, and with West Point able to furnish officers for little more than the standing army, an adequate defense against an invading force led by military engineers would require the services of countless civilian engineers to construct, operate and maintain the complicated mechanisms of resistance against foreign invasion.

In preparation for such an emergency, the resolution reads, the civil engineer must be familiar with the rapid construction of fortifications, bridges, roads and railroads; the mechanical engineer with the design, manufacture and operation of arms, ordnance, projectiles, submarines and aeroplanes; the electrical engineer with systems of military communication, the electrically operated mechanism of heavy ordnance, turrets, etc., the placing and exploding of submarine mines, and the chemical engineer with the practical manufacture of military explosives.

The Water-Power Bills

Senator Lewis, the Democratic party whip of the Senate, has urged President Wilson to call an extra session of Congress, pointing out that if he does so an opportunity will be given to pass the administration conservation bills. These bills are under consideration in connection with the possibility of an extra session.

Just before going West Secretary Lane made public a letter he wrote to Senator Myers, asking the latter to read it into the record in the Senate, in which Secretary Lane said he had had an interview with one of the most prominent hydroelectric engineers of the country and declared that the latter was prepared to put $10,000,000 into hydroelectric development in the West at once, and that this would be followed by an additional $30,000,000 within two years, if the public lands water-power bill is passed immediately. Within a week, Secretary Lane said, another engineer had told him that he was prepared to make a similar investment of $15,000,000. Secretary Lane appealed for the passage or at least the consideration of the bills as soon as possible.

Investigation of United Gas Improvement Company

Information obtained at the Department of Justice in Washington is to the effect that the Attorney General and his assistants having to do with the investigation of the United Gas Improvement Company have not yet made up their minds that the complaints which have been made against this company are well founded. This fact is so stated at the department.

It may also be said that there is no prospect at this time of a "consent decree" being entered against this company, for the reason that the company does not admit that any of the complaints made against it have a basis which would bring its operations within the intent and meaning of the anti-trust laws. Its attorneys, it is said at the department, are now preparing certain documents which the department has consented to receive and consider side by side with the complaints that have been made and the reports of its special agents.

New York Telephone Valuation

Testifying before the New York Public Service Commission, Second District, in the New York Telephone Company rate case, President Union N. Bethell of the company said that the greatest period of construction operations was last year. Since then the construction program has been cut by fully 50 per cent. Much of the non-employment in the city to-day is due to this change of program by most of the large public utility corporations. This is due to the "tax on business." In other words, some of the large corporations have reached the limit of expansion. A telephone company, Mr. Bethell said, should earn not less than 8 per cent. If a public service corporation is pushed down to the point of confiscation, it will injure the service because of the lack of reserve strength.

Testifying before the special legislative committee which is investigating telephone rates, Mr. C. Gordon Reel, consulting engineer, declared that reports submitted by the New York Telephone Company showed that it had control of seven other companies in the State prior to the merger of 1909, and that between 1911 and 1913 it absorbed twenty-eight opposition or independent companies and centered their control in the Friendship Telephone Company with $1,000,000 stock. Fifteen up-State telephone companies operating as independent corporations are controlled by the New York Telephone Company, he said.

Massachusetts Bill to License Electrical Contractors and Wiremen

Messrs. W. K. Tuohey, of Springfield, Mass., president, and A. J. Hixon, of Boston, chairman of the legislative committee of the Massachusetts Electrical Contractors' Association, appeared before the legislative committee on public lighting on Feb. 12 in support of a bill requiring the licensing of electrical contractors and journeymen electricians. Under the bill the Gas and Electric Light Commission is to appoint a board of three examiners of electricians who would be in charge of the examination and licensing of master electricians or contractors and journeymen. The proponents of the measure contended that it safeguards the public from the work of "basket" contractors and untrained and careless wiring installers. Mr. Walter L. Mulligan, general manager of the United Electric Light Company, Springfield, was recorded in favor of the bill. Mr. W. P. Briggs, New Bedford, pointed out that 1747 defective jobs were found last year in 2025 wiring in-

spections in New Bedford, and stated that only about five out of twenty-two wiring contractors in that city were doing first-class work. In the main public utility corporations are exempted from the bill. Mr. John P. Coghlin, a Worcester electrical contractor, favored the general features of the bill. Several smaller contractors objected to a provision that the contractor be prohibited from doing personal installation work, and the proponents accepted the amendment. The decision of the committee was reserved.

Mr. Mackay Suggests Higher Telegraph Rates

Mr. Clarence H. Mackay, president of the Mackay Companies, in his annual report to stockholders touched on several subjects of general interest. He suggested the possibility of an increase in telegraph rates as the result of higher labor and material costs, mentioned agitation for public ownership of telegraph and telephone lines, and called attention to the relative freedom of cable service from interference by the European war.

Department of Justice Investigation of Chicago Labor Situation

Mr. Charles F. Clyne, United States attorney for the district of Chicago, has reported to the Department of Justice that he is investigating a labor situation in that city which has developed from a strike involving light-fixture installations.

At the office of Mr. George Carroll Todd, assistant to the Attorney General, in Washington, it is said that there is no information as to the details or merits of the case, beyond a report from Mr. Clyne that he is having special agents make the investigation, and that it is a labor union which is being investigated. The name of the union is withheld at Mr. Todd's office for the present.

It is said in Washington, however, that the case presents a new feature among the many investigations and complaints which the department and its attorneys are asked to take up, for the reason that the labor union which is complained of is accused of having combined to restrain trade.

Mr. Davies on Trust Legislation

In an address on "Recent Trust Legislation" before the members' council of the Merchants' Association at the Hotel Astor, New York, on Feb. 17, Mr. Joseph E. Davies, United States Commissioner of Corporations, said in part:

"The spirit of the law and the purpose behind the law is that of even-handed justice—vigilant protection of the public interest from encroachments of dishonest business, and, as well, constructive help to business which is honestly and fairly desirous of accommodating itself to the law.

"Our modern industrial organism involves one-sixth of the total wealth of the nation. It affects approximately one-tenth of our population directly, and indirectly affects the well-being of our whole consuming public. One of the problems frequently alleged is uncertainty as to what the law prescribes. This legislation attempts to relieve that situation by specific definition to make that clear which cannot be done. A comprehensive body of information as to the constitution of the whole industry of the country will be obtained by the Federal Trade Commission. This information will be available to the solution of problems, and, consistently with what constitutes fairness as between competitors, will be available for the information and guidance of great and small business enterprise.

"In the course of time there will be available to the Federal Trade Commission a large body of information, collated, digested and interpreted, as to the whole field of industry of the country. The relative money values of the 350-odd classes of industry of the country, the degree of concentration in each, the character of integration between them, their processes, their problems, their local markets, their foreign markets, will all be available in this clearing house of information. This agency is also available in the public interest in investigations of the anti-trust laws.

"This information and expert knowledge is further made available by the law to the federal courts in the formation of dissolution decrees in trust cases, to the end that the public interest may be conserved, in that disinterested economic and expert knowledge of industry, as well as legal information, may be available in such situations. By direct authorization of the law, the commission may be called in by the Department of Justice to make recommendations as to the manner in which corporations may readjust their business so as to comply with the provisions of the law. This contains promise of great practical value to the business community.

"The commission is charged with the further duty of investigating conditions in foreign countries with reference to their effect upon our export trade.

"The greatest menace to the small business men or enterprises lies in unfair methods of competition employed by their larger rivals, who can withstand a campaign of price-cutting or similar practice simply by reason of brute strength. These practices, if permitted, breed monopoly. If prevented in their inception by government agency, there is a guarantee of a square deal to the smaller unit and an assurance that it will depend for its survival upon its own efficiency, and find justification therein for its existence. The theory of this law finds no quarrel with bigness of enterprise."

Keeping the Sigh Out of Psychology

Mr. William H. Childs, president of the American Coal Products Company, followed Commissioner Davies, saying in part:

"In good faith the government offers the trade commission bill as a method of meeting the business situation. Let us in the same spirit accept this offer and the suggestion of the government officials that we co-operate in working out this problem.

"The business world is not interested in any recriminatory partisan discussion as to who put the sigh in psychology, but is vitally interested in discovering a way of taking the sigh out of psychology and keeping it out. It will co-operate unselfishly and unceasingly with any body of men, administration or non-administration, for a non-partisan solution of the business issues.

"The first clause of the trade commission bill states that unfair methods of competition are declared unlawful. Of course they are unlawful, but what business men want to know is: What are unfair practices? In a recent suit brought by the federal government against a large Western corporation the judge and the attorneys left this to the jury to decide.

"The trade commission may decide that it will be advisable later on to ask for an amendment of the Sherman anti-trust act to cure this situation.

"In the development of this commission the power should be conferred upon it to supervise co-operative associations among business men in an open way, for the bettering of business conditions in all branches of the trade."

Massachusetts Commission Advises Against Central-Station Ice-Making

The special commission established by the Massachusetts Legislature of 1914 to investigate the ice business and report upon the desirability of placing it under state regulation and upon the expediency of permitting electric light and power companies to engage in the manufacture and sale of ice has filed its conclusions with the Legislature. It consisted of the Board of Gas and Electric Light Commissioners, the Public Service Commission and the Attorney-General.

The commission finds that the total amount of natural ice available in Massachusetts in 1913 was about 1,600,000 tons, and that the amount of manufactured ice for the same year was about 3.5 per cent of the foregoing. The production of artificial ice has made little headway in Massachusetts. About ten concerns are making ice, with a total capacity of about 400 tons per day, excluding hotel, market and railroad plants. The investment required to manufacture ice is about $1,000 per ton of daily capacity. If such a plant is run continuously at full capacity, ice can be produced at about $1 per ton, but the necessity for storage and the fluctuating demand of different seasons makes the estimated cost of storage range from $3 to $5 per ton of capacity against the $1 to $1.50 per ton required for the investment necessary to store natural ice. Evidence was presented to the commission that manufactured ice must be sold at from $2 to $3 per ton at the platform, ready for loading upon the wagons, to make the business profitable.

The commission points out that electrical energy can compete with steam or gas engines in ice manufacture only upon the basis of off-peak rates. It appears to be entirely possible to lessen or suspend the use of energy for a few hours daily with no substantial loss in ice-making efficiency, which makes the load attractive to central stations and accounts for the reported success of many small ice-making plants run in connection with central stations throughout the Middle West and South. As regards Massachusetts, the commission doubts if the charters of existing electric companies are broad enough to enable them to make and sell ice. In the codification of laws bearing upon electric companies enacted last year, the Legislature has restricted the powers of electric companies hereafter organized under general law to the making, distributing and selling of electrical energy. The proposal to authorize electric companies to engage in the ice business is a departure from present policy and is not recommended.

The chief grounds on which the proposal was urged were that the substantial and long-hour use of energy involved in ice-making made it an attractive load to obtain; that ice can be made more efficiently and economically, and the necessary installation financed, in connection with an operating electric station than independently, and that, the desirability of public regulation being assumed, it can thereby be the more easily extended over the ice business.

The commission does not question that ice-making may offer an advantageous field for the sale of electrical energy, but it does not follow that the companies should be authorized to enter the ice business. To obtain the load, under Massachusetts conditions, the companies would have to make a large additional investment, subject to a varying demand for product, and as a consequence might find any advantage gained more than offset by the inefficient operation of the ice-making apparatus due to enforced idleness in the winter months. There are many other businesses dealing with common necessities of life and desirable power consumers which require less investment and no more risk. The difficulties of regulation and supervision are increased, and the commission concludes, in view of the immense field already open for the manufacture, sale and distribution of electrical energy alone, that it would be unwise to divert the energies of the companies by entrance into the ice industry. The business is not a monopoly, although the large wastes tend to reduce unnecessary competition, and it is the opinion of the commission that it should not be placed under state supervision.

Mr. Edwards on the N. E. L. A. Accounting Section

At the 1915 convention accountants of member central-station companies of the National Electric Light Association will have a regularly organized accounting section for the first time. Full plans have been made for the organization of the section on independent lines but subsidiary to the parent body. At the request of the ELECTRICAL WORLD, Mr. H. M. Edwards, auditor of the New York Edison Company, who has been active in the accounting committee of the association for many years, most of the time as chairman, gave his ideas of the directions in which the proposed Accounting Section could work to be of greatest service.

"The by-laws of the N. E. L. A.," Mr. Edwards said, "provide for sectional work of the kind that the Accounting Section can do. They do not state exactly what the form of organization shall be, but, by providing that the by-laws of a section shall be submitted for approval to the executive committee of the parent body, they seek to retain control of it. The accounting committee, which has had the matter of organization into a formal section under consideration for some time, will submit by-laws at the next meeting of the executive committee of the parent association. It will also, as the by-laws require, submit an application of ten Class A members for authority to organize. If this is approved, organization will be effected with a chairman, vice-chairman, secretary, treasurer and executive committee, together with such other committees as may be deemed advisable. After these formalities the entire membership of the N. E. L. A. will be available for committee work in the Accounting Section, and it is hoped by those who are interested in the matter that, as the work develops, it will be possible to draw generally on the members in order to make the committees most effective and representative of the needs of the industry as a whole. The chairman of the Accounting Section will be ex officio a member of the executive committee of the parent body, and thus the section will keep in touch with the main association.

"At the last meeting of the accounting committee several committees were appointed to consider matters that are of present importance. In all probability the same committees will be needed for the future. These committees can lay a foundation for later work by the more highly organized section with its larger membership. It is assumed that the section will adapt itself rapidly and reach conclusions as to the best lines of future work.

"To the committee on the uniform system of accounts there was assigned for study and report an investigation of the distribution of overhead costs in companies which have different departments, such as electrical, electric railway and gas. What is the proper distribution of power-house costs between railway and lighting in a company which furnishes both classes of service? No standard exists, and accountants who consider the segregation of expenses of this nature are not agreed as to the best method. The committee was asked to get into touch with accountants of electric railway and

gas companies and find if concerted action can be taken to solve this problem. All are agreed that the subject should receive consideration, but after study the committee may find that cases where there is joint operation of different utilities are so dissimilar that general principles applicable to all cannot be formulated. The question may be a purely local one requiring separate decision in each case.

"Take, for instance, the accounts receivable bureau of the accounting department of a company providing electric and gas service, with 5000 electric meters and 10,000 gas meters. Assume that electric meters average gross earnings per year of $100 each and gas meters $40 each. That would make electrical operating revenues $500,000 and gas revenues $400,000. If the bureau expense were divided on the basis of proportionate gross earnings, the electric department, with one-half of the number of meters of the gas department, would stand five-ninths of the expense, whereas the actual amount of work involved would be only one-half as much as in the gas department. Some of the expenses involved would fall easily into one department or the other, but in that particular case gross earnings would not serve as a basis for division of the other expenses that cannot be allocated specifically. It is important to find what proportions of accounting department expenses other than those that pertain to customers' records, and what proportions of such expenditures as general officers' salaries, taxes which are general and cannot be allocated specifically, etc., belong fairly to each department.

"That this is a live question is shown by letters which I get from all parts of the country expressing some dissatisfaction because the uniform system of accounts does not deal with this phase of accounting. In reporting the uniform system the committee made it plain that no provision had been inserted for division of accounts between different departments, and that its judgment at that time was that the basis of distribution varies in each individual case. That was all that the committee was able to say then, but now, with more progress, it is proper to consider whether or not something different or new cannot be evolved. Of course, the N. E. L. A. has to act on accounting matters for the country as a whole, and any system of accounts that is devised must be sufficiently flexible to be adaptable to local conditions. In order that the committee may investigate the subject and throw all the light possible on it, special attention is called to it at this time. Another work for the committee on the uniform system of accounts will be that of keeping in constant touch with changes in our rapidly growing and developing business. If these require improvements in accounts, the standard system must be flexible enough to provide for them.

"Although the work of the new question box committee and the committee on the uniform system of accounts apparently will meet at many points, there is really a clear dividing line between the work of the two bodies. The committee on the uniform system of accounts will settle accounting principles and the question box committee will interpret them to members. The question box committee will not only consider matters that are raised from time to time but will publish in the *N. E. L. A. Bulletin* a statement inviting questions, to the end that accounting information may be distributed more widely.

"The study of cost-accounting principles by public utilities is a new field of investigation, and for that reason I judge that the committee to which this subject has been given will feel its way until it has become satisfied that it can do well and satisfactorily anything that it undertakes to accomplish. The real province of the first committee is to investigate in order to determine to what extent cost accounting can be considered with advantage. A number of theories have been advanced, but they deal with such general matters that it is difficult to know how to apply them so as to get substantial results. The theory of cost of service rather than value of service receives so much attention in some quarters nowadays that it is very evident that sooner or later earnest efforts will have to be made to develop satisfactory systems of cost accounting. Such systems cannot be evolved in a day or a year. It may take several years to get them to a point where they will come even tolerably near to principles which can be recommended for general acceptance.

"At some point every cost-accounting system requires individual judgment. If the judgment of any two individuals differs on the necessary allocation of costs, the results will also differ. To the extent that they differ uniform cost accounting becomes impossible. At the same time, it is very evident that some steps can be taken in the direction of study of the different questions concerned. It is hoped that the committee will be able to indicate the serious nature of the study and something of the complex steps which will have to be taken in order to determine cost-accounting principles which will be applicable with a degree of uniformity.

"The other committee, appointed as a convention committee, will try to arrange a program for the 1915 meeting of special interest to Western companies, from which a large attendance is expected.

"It is believed by those who are interested in promoting the Accounting Section that this new branch of association work will be of distinct benefit to all member companies. Within the last few years a heavy burden has been thrown upon accountants by the creation of public service commissions. Relations between companies and commissions are to a large extent in the hands of the accountants. For these reasons accountants need to devote the closest united study to problems affecting the industry at large. The best medium for such study is the new Accounting Section."

Tenney Companies Hold Successful Convention

An enthusiastic convention of executive officers, local managers, department heads and other members of the organization of C. H. Tenney & Company was held at the Engineers' Club, Boston, Mass., on Feb. 12 and 13. Representatives of nearly a score of utility properties under Tenney management in various parts of the East were in attendance, twenty papers being read and discussed in accounting and general sessions. The social features of the convention included luncheons at the Engineers' Club, an informal reception at the Copley-Plaza Hotel to delegates and ladies on Feb. 13, with a dinner and concluding dance. Tenney properties are situated in Massachusetts, New Hampshire, Vermont, Connecticut, New York and New Jersey, the headquarters being at Boston. From the management of two properties near Boston about thirteen years ago the Tenney syndicate has grown to embrace seventeen companies in the central-station, railway, gas and industrial field. The titles of the papers presented and their authors were as follows:

Accounting sessions: "The Office Manager," Mr. I. S. Hall, Boston; "Experiences as Office Manager," Mr. H. F. Pierce, Nyack, N. Y.; "The Importance of Issuing and Observing Instructions," Mr. H. A. Gidney, Boston; "Standardization of Records and Procedure," Mr. P. M. Scott, Boston; "Classification of Accounts," Mr. H. A. Gidney, Boston; "Methods of Handling Cash," Mr. A. G. Neal, Fitchburg, Mass.; "Methods of Collecting Accounts," Mr. G. W. Hurn, Haverhill, Mass.;

"The Importance of Watching Accounts Receivable," Mr. R. T. Whitney, Oswego, N. Y.; "Some Insurance Facts," Mr. H. E. Klein, Boston; "The Station Audit," Mr. A. W. Cary, Boston; "The Use of Accounts and Financial Reports," Mr. G. Duthie-Strachan, Boston.

General sessions: "Co-operative Purchasing Power," Mr. G. A. Rust, Boston; "Relations of the Local Manager to Charles H. Tenney & Company," Mr. J. T. Day, Malden, Mass.; "Cutting Down Expenses Without Impairing the Service," Mr. C. E. Paige, Malden; "Line Construction," Mr. Alexander Macomber, Boston; "Essentials of New-Business Development," Mr. John West, Boston; "Insurance," Mr. Clifton R. Hayes, Fitchburg, Mass.; "Good Housekeeping," Mr. A. E. Bliss, Malden; "Benefits of Periodic Inspections," Mr. H. D. Larrabee, Montpelier, Vt.; "Backing Up the Advertising Campaign," Mr. F. S. Clifford, Fitchburg.

Another interesting feature of the program was a "safety first" lecture by Mr. Elmor B. Tolstead, of the Independence Inspection Bureau, Philadelphia. Messrs. D. E. Manson and H. T. Sands of the executive offices, Boston, also addressed the convention.

Executive Committee of N. E. L. A. Commercial Section Meets

A meeting of the executive committee of the Commercial Section of the National Electric Light Association was held at the Hotel Sherman, Chicago, on Feb. 13. The following were present: Messrs. E. L. Callahan, Douglass Burnett, J. F. Becker, J. G. Learned, F. H. Gale, J. C. McQuiston, J. D. Israel, W. R. Collier, E. A. Edkins, N. H. Boynton, T. I. Jones and C. A. Littlefield, secretary, and Miss Burkhalter, assistant secretary. As guests there were present Messrs. R. S. Hale, D. H. Howard, H. R. Jenkins, G. M. Swain, E. W. Lloyd and George H. Jones.

On account of his resignation as manager of the new-business department of H. M. Byllesby & Company to become Chicago district manager of the Westinghouse Lamp Company, Mr. E. L. Callahan resigned as chairman of the Commercial Section. Mr. Douglass Burnett, one of the vice-chairmen, was elected chairman. Mr. E. A. Edkins was elected a vice-chairman in the place of Mr. Burnett.

Mr. R. S. Hale reported for the committee on the wiring of existing buildings. He referred to the approval of the report on standardization of plugs and receptacles by the executive committee of the main association. He said that Mr. H. E. Eisenmenger, of the National Lamp Works, is preparing a statement of the actual cost of wiring as quoted in different cities in the country. Mr. Hale also made an extended statement as to the wiring work on which the committee is engaged. After the presentation of the paper of Mr. S. E. Doane at the last N. E. L. A. convention the committee investigated to see why nothing had been done to provide cheaper wiring. It found that the code prevented further steps in this direction. A sub-committee undertook negotiations, and the result is that while the Underwriters will not now put proposed changes into the code permanently they will make such changes temporarily and will recommend that some of the central-station companies experiment with a few houses and will support this movement. Mr. Hale expressed the opinion that the next step is for central stations to wire a few houses so as to test costs and possibilities thoroughly. As no patent is involved, all manufacturers can make the necessary wire for experiments. Mr. Hale also called attention to the fact that while ordinarily central stations have waited for manufacturers to develop apparatus, in this case they have taken the lead and all manufacturers have an equal and fair chance. The possibilities of cheaper wiring open a large field not only in smaller houses but also in old substantial houses that under the old conditions would cost, say, from $500 to $1,000 to wire.

Mr. Edkins, chairman of the publications committee, reported that it is hoped to submit copy for the store-service campaign at the next meeting of the committee. This will consist of five or six folders with return post cards. The publications committee also proposes to reprint the booklet on "Wiring the Home" which is part of its residence-service campaign.

The report of Mr. Charles J. Russell, chairman of the power sales bureau, one of the committees of the Commercial Section, was presented by the secretary. A full day will be devoted to this subject at the June convention. The program will include the following: Morning session—Report on details of organization and scope of the work of the bureau, by the chairman; "Typical Power Sales Development in the West," Mr. J. H. McDougal and associates; report of sub-committee on electric furnaces and welding: (a) "Electric Furnaces for Operations Requiring Moderate Temperatures," Mr. C. W. Bartlett; (b) "Operation of a Steel Furnace," Mr. Walter M. McKnight, of Redondo Beach, Cal., or another author; (c) "Recent Development of Arc Furnaces," Mr. Booth, of Chicago; (d) "Charges for Electric Welding Service," Mr. C. K. Nichols, of New York. Afternoon session—Demonstration of a motor-service sale, Mr. C. H. Stevens, of Brooklyn. In the evening a banquet will be followed by a round-table discussion, according to a prearranged program. There will also be a motion-picture exhibition of coal-mining operations.

The report of Mr. R. R. Young, chairman of the committee on merchandising and recent development of energy-consuming appliances, was read by the secretary. The report to be presented by this committee at the June convention will include reports of sub-committees on merchandising, advertising, window and interior displays, sales force, recent development in household and industrial electric appliances, industrial-appliance business, bibliography of different committee subjects and inventory and stock-keeping methods.

Mr. Jenkins, as chairman of the committee on the education of salesmen, gave an outline of the correspondence courses which the committee is preparing. The idea is to establish practical commercial courses, not courses in electrical engineering.

Subject to final approval by the chairman the next meeting will be held in New York on April 3.

Essentials of New-Business Development

At the convention in Boston, Mass., last week of managers of Charles H. Tenney & Company a paper on "The Essentials of New-Business Development" was presented by Mr. John West, manager of the new-business department of the Tenney syndicate. The author emphasized the importance of employing in the new-business department men whose intelligence, skill and ability will command public confidence. Clumsy, callous persons do not make good new-business solicitors. Encouragement of good canvassers throughout an organization is important and introductions to congenial associates are desirable in taking up new fields of service. Reliable commercial and engineering data are second in importance only to experience itself. Mr. West emphasized the necessity of maintaining an up-to-the-minute card record of prospective customers which should be periodically checked by the management.

In dealing with men whose work strains their resources and whose efficiency of effort must depend upon

an optimistic state of mind, a few words of praise are essential to keep up the enthusiasm necessary for success. One large company has an open book in which any employee may register a "boost" for the work of his fellow employees, and these are read aloud at each weekly meeting. The idea started in the new-business department and is now being used by all departments of the company as a popular source of inspiration to the men. Ninety-five per cent of the "flunks" of employees of a large Eastern central station were traced to poor management.

Manufacturers' Conference on Standardizing Plugs and Receptacles

At the invitation of Mr. R. S. Hale, Boston, Mass., chairman of the N. E. L. A. committee on the wiring of existing buildings, a conference of manufacturers of plugs and receptacles was held in the N. E. L. A. headquarters, New York, on Feb. 15. Although the manufacturers represented did not commit themselves in any way at this conference, the general sense of the meeting was that two types of plugs and receptacles for use on lighting circuits—that is, circuits carrying not more than 660 watts—could be standardized.

It was thought that Edison screw-type wall and baseboard receptacles were not desirable because of liability of shock, danger of short-circuits due to accumulation of dust, etc., and that receptacles having channels for the reception of prongs were preferable. Upon this basis the subject of plugs and receptacles was discussed.

The sense of the meeting then was that the channels for the reception of the prong-connecting members for separable attachment plugs and receptacles, and hence the prongs of the prong-containing members, should be standardized. The question then arose whether those prong-attaching plugs requiring a straight pull for removal were superior to those that can be withdrawn at an angle. In present types of the former the contacts in the channels for the reception of the prongs are more or less inaccessible, and hence the danger of shock and of short-circuits due to dust, etc., is a minimum. The latter type does not at present possess these advantages, and it was thought doubtful if the contacts in the channels could be made inaccessible and still maintain the angle-of-pull feature which is advantageous in that strains due to one tripping over a cord, etc., are merely likely to pull out the plug and not the fixture to which it is attached as is liable to happen where plugs of the straight-pull type are used. No decision could be reached as to which type was preferable, and it was thought best to standardize both at the present time for non-polarity and polarity plugs and receptacles and let future usage decide which type is preferable. The discussion then was given over to the arrangement of the channels. One channel containing contacts for both sides of the circuit was not deemed to be a desirable form. Parallel channels were thought to be better than channels in alignment as less space is required. For polarity plugs channels at right angles were thought advisable.

It was decided to adjourn the meeting until March 4, at which time meetings of manufacturers of plugs and receptacles of both types will be held, Mr. Hale sending invitations to all such manufacturers to be present. Separate meetings of manufacturers producing plugs and receptacles of the straight-pull type and of those producing plugs and receptacles of the angle-of-pull type will be held at 10 a. m. on that day in the N. E. L. A. headquarters, New York City. In the afternoon a joint meeting of both classes of manufacturers will be held at 2 p. m. in conference with Mr. Hale. It was thought that no patent difficulties will be experienced in standardizing angle-of-pull plugs and receptacles but that such difficulties will be experienced in trying to standardize plugs and receptacles of the straight-pull type. However, it was thought that the patent difficulties would be overcome.

At the conference on Feb. 15 the following firms were represented: General Electric Company, Schenectady, N. Y.; Trumbull Electric Manufacturing Company, Plainville, Conn.; E. H. Freeman Electric Company, Trenton, N. J.; Manhattan Electrical Supply Company, New York City; H. T. Paiste Company, Philadelphia; Harvey Hubbell, Bridgeport, Conn.; Bryant Electric Company, Bridgeport, Conn.; Arrow Electric Company, Hartford, Conn.; Metropolitan Electrical Manufacturing Company, New York City, and Hart & Hegeman Manufacturing Company, Hartford, Conn.

Change of Date for New England Electrical Convention

The "question box" convention to be held next month under the auspices of the New England Section of the National Electric Light Association will meet at the American House, Boston, on March 11 and 12, instead of on March 9 and 10, as previously announced. The program will be entirely informal, as stated in a recent issue, and is planned to bring out the utmost freedom of discussion on topics of central-station, electric-vehicle and related interests.

Suggested Changes in the National Electrical Code

The electrical committee of the National Fire Protection Association has issued a bulletin containing committee reports, recommendations and suggestions for changes in the National Electrical Code to be considered at the meeting of this committee at the New York headquarters of the association on March 24 and 25. The bulletin contains twenty-seven pages, of which about twelve are devoted to committee reports and about ten to suggested changes in the code.

Among the most important material contained in this bulletin is the report of the switch and cut-out committee which, after reviewing test data and field experience with the refillable type of inclosed fuse, recommends that recognition of the principle of refillable fuses in the code be withheld. The committee on transformers recommends the insertion of rules for toy transformers in the code. It is recommended that the primary voltage rating be limited to 125 volts and the secondary voltage rating to 25 volts. Rules covering their construction are included. More specific rules are recommended for transformer-casing construction.

Extensive changes are recommended in the rules on cabinets by the committee having this matter in hand. These rules, however, relate mainly to construction features of cabinets and the space between the cabinet and the inclosed apparatus and the apparatus itself. Extensive but comparatively minor changes are recommended by the committee on fixtures.

The committee on grounded concentric wiring systems, as stated in the ELECTRICAL WORLD of Feb. 6, does not at this time recommend the inclusion of any rules on concentric wiring in the code, but has prepared a preliminary draft of suggested requirements for concentric wiring. The committee on safety to life recommends that Rules 20, 21 and 22, on constant-current series arc-lighting systems, be entirely omitted from the code and that Rule 23, on automatic cut-outs, be revised to provide for the inclosure of arc lamps on constant-potential circuits under the same provisions as at present made in Rule 21.

Miscellaneous News Notes

Awards Prizes for Efficiency Suggestions.—The Oregon Power Company, Eugene, Ore., recently awarded a prize for the best method of increasing its plant efficiency. By means of the contest just closed it has secured numerous suggestions on how operating conditions can be bettered and has also induced its employees to spend some thoughtful moments on how to eliminate losses.

Decree in Utah Land Case.—Judge Marshall of the United States District Court at Salt Lake City, Utah, ordered a decree on Feb. 15 declaring that the Utah Power & Light Company and the Beaver River Power Company are illegally occupying government land and enjoining such further occupancy. The property involved is in the Cache, Filmore and Wasatch national forests in Utah. The cases have been pending about three years. The companies will appeal to the United States Supreme Court.

Boston Engineers' Dinner.—At the new home of the Boston (Mass.) City Club on Feb. 15 was held the sixth annual dinner of civil, electrical and mechanical engineers affiliated with the local branches of the national engineering societies and the Boston Society of Civil Engineers, the attendance being 267. The toastmaster was Mr. James W. Rollins, past-president of the Boston society, and the speakers were Hon. David I. Walsh, Governor of Massachusetts, and Messrs. Harrison P. Eddy, president Boston Society of Civil Engineers; Charles Whiting Baker, editor *Engineering News*, New York; Charles H. Eglee, Boston, and Capt. Robert A. Bartlett, of the Peary polar expedition.

Brooklyn Edison Company Entertains Electrical Contractors.—The electrical contractors of the Borough of Brooklyn were tendered a dinner at the Academy of Music on Feb. 10 by the Edison Electric Illuminating Company of Brooklyn. About 300 were in attendance. Mr. T. I. Jones, general sales agent of the company, acted as toastmaster and speeches were made as follows: "The 1915 Outlook" by Mr. W. F. Wells, vice-president of the company; "The Contractor and the Company" by Mr. Louis Kalischer, president of the Kilowatt Club; "The Public Service Commission" by Mr. E. E. McCall, chairman Public Service Commission, First District, New York; "The Department of Water Supply, Gas and Electricity" by Mr. W. Williams, commissioner of the department. Mr. L. H. Pounds, president of the Borough of Brooklyn, also spoke.

Fluctuating Money Rate and the Fixed Rate of Return.—Mr. E. W. Doty, of Cleveland, a member of the Ohio Public Utilities Commission, in discussing valuation problems before the National Independent Telephone Association at Chicago, Feb. 4, declared his belief that the principle of establishing a fixed rate of return for public-utility properties is wrong. The rate of return on capital, he said, fluctuates from day to day and from year to year, and the utilities must use capital to continue in business. It is wrong, therefore, to fix for a period of years a rate more than which utilities may not earn. Utilities should be allowed to make a charge for service which is high enough to attract capital to the enterprise. Mr. Doty also said that he believed in allowing a greater rate of return to the efficiently operated companies and to the companies furnishing good service than to those which supply inadequate and inefficient service to their patrons.

Chicago Utility Minstrels Net Nearly $25,000 for Charity.—The minstrel show for the benefit of charity given by the employees of the Commonwealth Edison Company, the Chicago Telephone Company and the People's Gas Light & Coke Company at the Auditorium Theater, Chicago, Feb. 9 to 12, earned nearly $25,000. The receipts will be turned over intact to the United Charities organization of Chicago, all expenses of the production being borne by the utility companies. A supervisory committee made up of vice-presidents of the three companies—Mr. J. F. Gilchrist of the Edison company, Mr. H. F. Hill of the telephone company, and Mr. J. M. Williams of the gas company—had general charge of the undertaking. Mr. W. L. Abbott of the Edison company was chairman of the joint general committee, Mr. Homer Niesz had charge of arrangements, and Mr. G. B. Foster had charge of program and publicity. Five performances were given.

Associations and Societies

Chicago Section, A. I. E. E.—At a meeting of the Chicago Section, A. I. E. E., in the rooms of the Western Society of Engineers, Chicago, Feb. 23, Mr. Edward Schildhauer, formerly electrical and mechanical engineer for the Isthmian Canal Commission, will speak on "Features of the Mechanical and Electrical Design of the Panama Canal."

Arkansas Association of Public Utility Operators.—At a meeting of the executive committee of the Arkansas Association of Public Utility Operators held at the office of the Little Rock Railway & Electric Company on Feb. 9 the date for the 1915 meeting of the association was fixed for May 11, 12 and 13 at Little Rock, with headquarters at Marion.

Detroit Electrical Contractors' Association.—The Electrical Contractors' Association of Detroit held its annual meeting and banquet Feb. 10 at the Hotel Cadillac. Mr. E. McCleary acted as toastmaster, and the following officers were elected: President, Mr. John Gray; vice-president, Mr. Alex Nimmo; secretary, Mr. George Jacob, and treasurer, Mr. W. D. Gale.

Semi-Annual Rejuvenation of Detroit Jovians.—The Detroit Jovians held their semi-annual rejuvenation at the Board of Commerce Feb. 13, with an attendance of 200. Twenty-eight new members were initiated. The principal address of the evening was delivered by Mr. R. S. Hale of the Edison Electric Illuminating Company of Boston, who spoke on concentric electric-wiring systems.

Illuminating Engineering Society.—At a meeting of the council of the Illuminating Engineering Society held on Feb. 11 the committee on time and place, of which Mr. G. H. Stickney is chairman, recommended that the 1915 convention of the society be held in Washington, D. C., during the third or fourth week in September. Plans are under way to arrange for the convention in accordance with the committee's recommendation.

Lecture on "Artificial Lighting."—At a meeting to be held on March 1 at "The Lighthouse," 111 East Fifty-ninth Street, New York, under the joint auspices of the New York Association for the Blind, the American Medical Association, the Illuminating Engineering Society and the New York Board of Education, a lecture on "Artificial Lighting" will be delivered by Mr. L. B. Marks, past-president of the Illuminating Engineering Society.

New York Electrical Society.—At the meeting of the New York Electrical Society on Feb. 17 Mr. Putnam A. Bates, electrical engineer of the Fire Department of New York City, gave an illustrated lecture on "The Fire-Alarm System of New York City." The speaker reviewed the past history of the system, pointing out its shortcomings, and outlined plans which have been formulated to improve the system in all boroughs. After this lecture, Mr. L. G. Harkness-Smith, motion-picture director of the Society for Electrical Development, supervised tests comparing motion-picture films exposed with light from multi-arc and mercury-vapor lamps. The films were developed, fixed and dried during the tests so they could be examined for relative characteristics. Positions of lighting units were recorded to show conditions existing while pictures were being taken.

Empire State Meter Committee Meets.—The committee on electric meters of the Empire State Gas and Electric Association met in the auditorium of the Technology Club at Syracuse on Feb. 10. Mr. C. G. Durfee, chairman of the meter committee, presided. Sixty-eight persons were present. Electric utility companies of the State were well represented. This was the second of a series of meetings to be held during the year. Attention was called to the great improvement over the first meeting. The attendance was over three times as large, and the younger men present had lost their former reticence and entered freely into the discussion. The subject under discussion was "Proper Methods of Metering Multiphase Circuits." Since there is not sufficient time at the annual conventions for discussion of metering problems in detail, the officers of the association have felt that if three or four meetings of this nature were held each year they would result in getting each meterman in close touch with all the meter departments in the State. The meetings will be held in different parts of the State, in order

that each meterman may attend at least one meeting a year. The next meeting will be held in April, probably in Buffalo, although this has not been decided definitely.

Meeting of Empire State Association.—The second of the midyear meetings of the Empire State Gas and Electric Association will be held in the Hotel Utica, Utica, N. Y., on Feb. 26, beginning at 10 a. m. The principal subject will be "Gas and Electric Distribution Maps and Records." The executive committee will also have other matters to present for consideration. Questions are arising every day in regard to the preparation of schedules of rates in accordance with the order of the New York Public Service Commission, Second District. This meeting will afford a good opportunity to compare notes as to the progress being made and to discuss some of the more complicated phases of the matter.

Association of Iron and Steel Electrical Engineers.—The Association of Iron and Steel Electrical Engineers of Pittsburgh, Pa., held its regular monthly meeting on Feb. 6. Mr. S. C. Coey, assistant superintendent of the mechanical and electrical departments of the Youngstown (Ohio) Sheet & Tube Company, read a paper on "Relation of Physical Examination to Electrical Work," in which he brought out the necessity and desirability of examining the eyes of employees monthly to determine what result artificial illumination is having upon the eye-strain. Mr. Sidney McCurdy, resident surgeon of the Youngstown Sheet & Tube Company, told of the policy of physical examination and the advantages gained thereby, and Dr. W. O'Neil Sherman, chief surgeon of the Carnegie Steel Company, spoke of the antagonism shown by labor organizations toward physical examination.

Branches of Philadelphia Section, N. E. L. A., Meet in Groups.—The Philadelphia Electric Company has found it very effective to have closely related departments of its organization conduct joint meetings. For instance, on Jan. 5 the engineering and commercial branches of the company section of the National Electric Light Association held a combined meeting, and on Jan. 12 the accounting and meter branches joined forces. At the engineering-commercial meeting Mr. R. B. Ely abstracted the illuminating section of the "Electrical Salesmen's Handbook" and pointed out how it can be of practical benefit to solicitors. Mr. P. H. Bartlett described the Stannos method of wiring houses, and Mr. Harold C. Goodwin, Jr., discussed distribution problems. Prizes were presented to three solicitors who had introduced the largest number of appliances on the system during a recent contest. The topic of interest at the meeting of the accounting and meter departments was "Modern Implements of War and Their Use by Our Navy," the speaker being Lieutenant-Commander Harold Earle Cook, U. S. N., inspector of ordnance for the Midvale (Pa.) Steel Company.

National Independent Telephone Association.—Among the talks and papers presented at the eighteenth annual convention of the National Independent Telephone Association in Chicago Feb. 3, 4 and 5 were: "The Telephone Problem," by Mr. Richard Yates, of the Illinois Public Utilities Commission, Springfield, Ill.; "Valuation of Telephone Properties," by Mr. E. W. Doty, of the Ohio Public Utilities Commission, Cleveland, Ohio; "Public Convenience and Necessity," by Mr. Lawton T. Hermans, of the Michigan Railroad Commission, Lansing, Mich.; "Interstate Commerce Commission Accounting Systems," by Mr. John W. Van Sant, examiner of accounts, Interstate Commerce Commission, Washington, D. C., and "Depreciation," by Mr. E. C. Hurd, formerly engineer for the Nebraska Railroad Commission, Lincoln, Neb. Election of officers resulted as follows: President, Mr. C. Y. McVey, Cleveland, Ohio; vice-president, Mr. T. W. Allen, Jackson, Tenn.; secretary-treasurer, Mr. F. B. Mackinnon, Washington, D. C.; board of directors, Messrs. T. W. Allen, Jackson, Tenn.; S. G. McMeen, Columbus, Ohio; W. R. McCanne, C. Y. McVey, Cleveland, Ohio; N. G. Hunter, Wabash, Ind.; W. C. Handlan, Wheeling, W. Va.; J. B. Earle, Waco, Tex.; P. C. Holdogle, Rockwell City, Ia.; F. B. Mackinnon, Washington, D. C.; L. D. Critchfield, Chicago; A. F. Adams; C. E. Tarte, Grand Rapids, Mich.; A. G. Bean, Elyria, Ohio; L. D. Kellogg, Chicago; H. B. McMeal, Chicago; L. F. Hurtz, Lincoln, Neb., and Sam Harper, Pittsburgh, Pa.

Public Service Commission News

Maryland Commission

The commission has been advised by Mr. Osborne I. Yellot, people's counsel, to investigate upon its own initiative the Easton Light & Fuel Company. Former Mayor Martin Higgins of Easton filed the first complaint against the company after the commission was organized. His and other complaints were dismissed a short while ago without prejudice to the right of the complainants to ask for an investigation again.

New York Commissions

During his testimony before the legislative committee which is investigating the commissions Mr. J. Sergeant Cram, member of the First District commission, said that men who would make able commissioners would earn much more in outside employment than the salary of $15,000 per annum which is paid. He said that he did not believe in the practice of the commission in holding secret meetings as a committee of the whole. As in the case of Chairman McCall, records were introduced to show the use of a commission automobile by Mr. Cram. Mr. Cram declared that he had been responsible for safety rules that had saved the lives of many employees of the great electrical companies.

Commissioner Robert Colgate Wood was asked regarding a private telephone in his office. He declared that the city paid for the telephone until the end of October, but that from that time he had met the cost himself. He said that he had used the private telephone in transacting public business in the way of acknowledging and inquiring about complaints which came to him in his official capacity.

Commissioner George V. S. Williams was asked mainly about transit and signal matters and alleged violations of orders requiring additional urban railway service. In answer to one question Mr. Williams said that he did not regard it as just and reasonable to require a company to buy cars that it might have to throw away in eighteen months.

In the annual report of the Second District commission a section is devoted to the work of the division of capitalization. This section says in part:

"Several applications for authority to issue securities with which to acquire the plant and property, or securities, of other corporations engaged in the same business in adjoining localities have been passed upon by the commission. In many such cases it is found that the purchasing corporations are obliged to pay a price somewhat in excess of the original cost of the physical property. The difference in price involves the strategic advantage of the vender, the possibility of competition, and in most cases the business which has been developed. The commission has found it to be for the best interests of all concerned to permit corporations with generating stations of large rating which operate at a low cost to acquire small plants in their territory, especially when approved by local authorities. This results in some cases in the immediate retirement and abandonment of a considerable portion of the physical property acquired. To limit the purchasing corporation to paying for such plants only the inventory cost of the actual physical property which will remain after the changes have been made might occasionally prevent such transactions, many of which have shown large benefits to all concerned. In cases where there has properly appeared any difference between the inventory cost of the physical property to be taken over and the price authorized to be paid therefor, such difference shall be amortized or charged off from earnings during a reasonable period of years. This practice is working out satisfactorily because it eventually results in a conservative statement of the property accounts of the acquiring company and at the same time makes possible an immediate putting into effect of the savings resulting from the progress of the art, large-scale production and reduced administrative expense.

"The commission is required to pass on the forms of mortgages and other trust indentures given by public service corporations. The current financial depression illustrates that a strong agency for the encouragement of conservative management and the protection of the credit of supervised corporations is that the mortgage debt of the companies shall be secured by an agreement which, so far as may be,

insures that the earnings of the corporation shall in the first instance be applied toward the full maintenance of the mortgaged property, including a proper allowance for wear and tear, obsolescence and inadequacy.

"In last year's report attention was called to the lack of care in the preservation of important vouchers, contracts and other records by many corporations. This condition has not improved. While the better-managed corporations are alive to the value of preserving their early records, many documents which are of vital importance in establishing the integrity of capital accounts are mislaid and eventually lost, largely on account of carelessness and unsystematic filing systems. Unless the matter receives better attention, the uniform systems of accounts should make the preservation of such records mandatory.

"The methods of filing vouchers of many public service corporations are very unsatisfactory. Some file alphabetically by names of payees. This is objectionable from the standpoint of review or audit, for the reference may not be sufficiently definite to enable the prompt finding of the voucher in question. Others file in numerical order by months, beginning with a new number each month. This results in confusion. Others renumber vouchers each year. This is better, but confuses vouchers of different years. A very satisfactory method, and one which is followed by a majority of the corporations, is to number the vouchers consecutively until the numbers run to five figures and then begin over again. Corporations whose vouchers are kept in this manner can be examined with less irritation to their accounting departments and at a much less expense to the State.

"Many corporations separate the evidence of payment from the original invoice, the treasurer retaining the former and the accounting department the latter. Frequently, even in one office, the invoices and checks are filed separately. This is not good practice, as it is desirable that the invoice and the evidence of its payment should be together. Receipts for the canceled checks can be furnished the treasurer by the accounting office if desired.

"Many corporations have their own form of invoice which the supply house is required to use. This has been found to be unsatisfactory, as each manufacturer or supply company usually has the form of invoice best suited to its business. Furthermore, its employees are trained in preparing statements on such forms. When the form of some public service corporation is used, not infrequently the information furnished is insufficient. It is also wasteful. All the advantages of a uniform voucher are secured by using backers attached to the invoices received.

"The uniform systems of accounts which have been adopted by this commission require that throughout all capital accounts the first entry in respect of any particular thing shall describe it with such particularity as to lead to its immediate identification. No serious attention is paid by many corporations to this fundamental requirement. For so-called 'statistical' accounts, such as meters, transformers, etc., or 'inventory' accounts, such as tools and implements, office furniture and fixtures, etc., the original invoices, duly receipted, usually contain sufficient information. In the case of expenditures for additions and betterments to buildings or to continuous structures, railroad track, electric line, pipe line and similar matters it is essential that a record shall be kept by projects. Charges to a fixed capital account of a portion of a payroll, various quantities of materials, etc., do not enable an examiner to form an intelligent conception of the character of the expenditures, and yet many promiscuous charges of this sort are dumped into capital accounts which cannot be justified later."

Pennsylvania Commission

Judge McCarrell in the County Court of Dauphin County, Pa., has dismissed the appeal of the Public Utilities Company from the order of the Pennsylvania Public Service Commission which permitted the Lehigh Navigation Electric Company to cross its right-of-way with high-tension wires. The court holds that a company incorporated prior to the passage of the public service company act of 1913 was not required to secure a certificate of public convenience in the territory covered by its charter, although contracts made with municipalities and other public service companies would have to be acted upon by the commission.

Personal

Mr. Lee H. Parker, until recently electric-railway engineer of the Stone & Webster Engineering Corporation, Boston, Mass., has become president of the Spray Engineering Company, with offices at 93 Federal Street, Boston.

Mr. Louis Brownlow has been named to succeed Mr. Frederick L. Siddons as a member of the Public Utility Commission of the District of Columbia. Mr. Siddons has been appointed associate judge of the Supreme Court of the District.

Mr. C. J. Griffith, general manager and treasurer of the Little Rock (Ark.) Railway & Electric Company, has been elected president of the Chamber of Commerce of that city. Mr. Griffith is one of the few active public utility operators to be elected to an office of this kind.

Mr. F. H. Lane has been appointed manager of the departments of examinations and reports of H. M. Byllesby & Company, Chicago. Mr. Lane has been with the Byllesby company for nearly eleven years and has participated in many of the important investigations and appraisals made by the department, of which he became the head Feb. 1.

Mr. Edward P. Burch, electrical engineer of the class of 1892, College of Engineering, University of Minnesota, has opened an office as consulting engineer in the Dime Bank Building, Detroit, Mich. General practice is contemplated, with specialization in mechanical and railway work and in property valuations. Mr. Burch has recently completed, in connection with Mr. Edward W. Bemis and Mr. Charles L. Pillsbury, the valuation of the street-railway property of Detroit. It is understood that Mr. Burch will also continue his Minneapolis office.

Mr. Walter N. Cargill, of the Stone & Webster Engineering Corporation, Boston, Mass., has been appointed superintendent of power and lines of the Rhode Island Company, Providence, R. I., and will assume the duties of his new position on April 1, 1915. Mr. Cargill is a native of Liberty, Maine, and after being graduated from the University of Maine in the electrical engineering course in 1900, entered the engineering service of the electric-traction system which is now the northern division of the Bay State Street Railway, becoming superintendent of power stations in 1903. He became a member of the Stone & Webster organization in 1911 and has been largely engaged since in the mechanical aspects of power-plant engineering, including appraisals and investigations. Mr. Cargill is a member of the New England Street Railway Club and the American Society of Mechanical Engineers and an associate member of the American Institute of Electrical Engineers.

Mr. Robert M. Feustel has tendered his resignation as chief engineer of the State Public Utilities Commission of Illinois, to take effect March 1, 1915. Mr. Feustel, who is a member of the firm of Sloan, Huddle, Feustel & Freeman, consulting engineers, of Madison, Wis., was formerly assistant chief engineer of the Railroad Commission of Wisconsin. His withdrawal at this time is for the purpose of resuming his consulting engineering practice with the above firm, which practice he temporarily relinquished in order to organize the engineering department for the Illinois commission. During the past year the organization of the engineering staff has been effected, rules establishing standards of service for various types of utility properties have been prepared for the commission's adoption, and the general method of collecting data for rate-making cases has been outlined. The commission will issue the latter information in pamphlet form in the near futre. It is understood that the commission has not as yet selected a successor to Mr. Feustel.

Mr. Harry M. Hope, for the past four years assistant engineering manager of the Stone & Webster Engineering Corporation, Boston, Mass., will sever his connection with the Stone & Webster organization on March 1 to establish an office for the practice of general electrical and mechanical engineering at 141 Milk Street, Boston. Mr. Hope is a native of Niles, Mich., and after attending the Northwestern University and the Lewis Institute of Technology, Chicago, joined the staff of the Chicago Edison Company in 1902 as assistant in the testing laboratory. Previous experience included work in the engineering, accounting and operating departments of the Muskegon (Mich.) Traction & Lighting Company and the installation of a number of small electric-

lighting plants in Michigan. At the beginning of 1904 Mr. Hope was made electrical engineer of the North Shore Electric Company, Chicago, and in June, 1907, he joined the Stone & Webster organization. Mr. Hope is a member of the National Electric Light Association and the New England Street Railway Club and is a fellow of the American Institute of Electrical Engineers.

Mr. Anthony J. Bemis, who has opened an office as consulting engineer in electric railway and lighting work at 39 South LaSalle Street, Chicago, has had a varied experience in the field of utility engineering, construction and operation. In 1898 Mr. Bemis joined the Stone & Webster organization as manager of its Maine properties, later becoming manager of the Brockton & Plymouth Railway for two years. Another year was spent as manager of the Cape Breton Electric Company. From 1903 to 1905 Mr. Bemis represented the Stone & Webster company at its properties at Savannah, Ga., Jacksonville, Fla., Columbus, Ga., and Tampa, Fla. In 1905 he was appointed general manager of the Grand Rapids - Muskegon Power Company, Grand Rapids, Mich., in charge of construction and operation. In 1909 Mr. Bemis joined the staff of J. G. White & Company, acting for a time as general manager of the Oklahoma Railway Company, Oklahoma City, Okla. In 1912 he became engineer in charge of construction and operation for Elston, Clifford & Company, utility operators, Chicago, supervising construction of plants at Vicksburg, Miss., and Mineral Point, Wis. Mr. Bemis will retain his present connection with the Elston-Clifford company, but will devote his consulting engineering practice to reports, investigations and valuations of utility properties, and to advice on operating and commercial problems in connection with electric utilities.

A. J. BEMIS

Mr. Hugh Hazelton, who is associated with Mr. L. B. Stillwell, past-president of the American Institute of Electrical Engineers and consulting engineer of New York, was born in Chicago, Ill., Aug. 16, 1868. He was graduated in 1890 from the mechanical and electrical course at the University of Illinois, and after graduation was employed by the Westinghouse Electric & Manufacturing Company of Chicago for a time on electric lighting and railway work. Mr. Hazelton was subsequently connected with Mr. D. L. Barnes, consulting engineer of the Chicago & South Side Elevated Railroad. During the World's Fair Mr. Hazelton collaborated with Mr. B. J. Arnold on the design and construction of the Intramural Railway, the first in which electric motors were used to propel trains of cars in elevated service. In 1895 the Metropolitan West Side Elevated Railroad of Chicago decided to adopt electricity as the motive power, and Mr. Hazelton was employed on this work for about five years, throughout the period of design and construction. In 1899 the Manhattan Elevated Railroad of New York City decided to substitute electricity for steam, and Mr. Hazelton was one of a number of Chicago engineers who were called to New York in connection with this development. Mr. Hazelton served for three years as assistant electrical engineer and two years as electrical engineer of the Manhattan Elevated Railroad, from which position he resigned in 1905 to become associated with Mr. L. B. Stillwell in consulting engineer work in New York City.

HUGH HAZELTON

Corporate and Financial

Central Maine Power Notes Sold.—Bond & Goodwin of New York have sold $600,000 of three-year 6 per cent notes of the Central Maine Power Company at par and interest.

Stone & Webster Manual.—Stone & Webster, of Boston, have issued their 1915 manual giving the financial status of the companies under their management as of Dec. 31, 1914.

Middle West Utilities Bonds.—A. H. Bickmore & Company, of New York, are offering at 94.61 ten-year 6 per cent collateral gold bonds dated Jan. 1, 1914, of the Middle West Utilities Company, of Chicago, Ill.

Central Illinois Light Bond Offering.—Hodenpyl, Hardy & Company of New York are offering at 92 and interest first and refunding mortgage thirty-year 5 per cent gold bonds of the Central Illinois Light Company, due April 1, 1943.

Wisconsin-Minnesota Light & Power Bond Offering.—Harris, Forbes & Company of New York are offering at 93½ to net 5.45 per cent $71,500 of first and refunding 5 per cent mortgage bonds of the Wisconsin-Minnesota Light & Power Company.

Dallas Electric Bond Offering.—Perry, Coffin & Burr of Boston, Mass., are offering $150,000 Dallas (Tex.) Electric Corporation first mortgage collateral trust 5 per cent bonds due April 1, 1922, at 97½ and interest, yielding in excess of 5.4 per cent.

Puget Sound Traction, Light & Power Bond Offering.—Harris, Forbes & Company of New York have sold at 100½ $557,000 of five-year 6 per cent mortgage gold bonds, dated Jan. 15, 1914, of the Puget Sound Traction, Light & Power Company to net 5.85 per cent.

Central New York Gas & Electric Bond Offering.—W. C. Langlay & Company of New York are offering at 95½ and interest to yield over 4.3 per cent $123,000 first mortgage 5 per cent sinking-fund bonds of the Central New York Gas & Electric Company.

Worcester Electric Light Stock Offering.—Shareholders of the Worcester (Mass.) Electric Light Company have been offered the privilege of subscribing to 1000 new shares at 200 in the ratio of one share of new stock for every thirteen shares of old stock held on Dec. 16, 1914. The time for subscription is limited to April 10, 1915.

Stock Exchange Listings.—The following securities have been placed on the list of the New York Stock Exchange: $32,000 additional first and refunding mortgage 5 per cent bonds payable July 1, 1934, of the Virginia Railway & Power Company and $2,156,100 additional common stock of the Westinghouse Electric & Manufacturing Company.

Pacific Power Company Promissory Notes.—The Railroad Commission of California in a supplemental order has authorized the Pacific Power Company to issue three promissory notes totaling $76,000 in favor of Messrs M. D. Thatcher, L. C. Phipps and DeLos A. Chappell. The notes are to be issued in lieu of seventy-six promissory notes of $1,000 each, authorized on Oct. 6, 1914.

Pacific Light & Power to Issue Bonds.—The Railroad Commission of California in a supplemental order has authorized the Pacific Light & Power Corporation to issue $170,000 first and refunding mortgage bonds at not less than 85 and interest. The company proposes to use the proceeds to reimburse itself in part for $208,000 paid to the trustees and in order to satisfy the sinking-fund provision of the mortgage.

Detroit Edison Annual Report.—The annual report of the Detroit (Mich.) Edison Company for the year ended Dec. 31, 1914, shows the output to have increased 11.1 per cent, or from 282,484,300 kw-hr. in 1913 to 313,718,600 kw-hr. in 1914. The number of customers connected increased from 90,552 to 105,530. Of the new connections four-fifths were to private residences. Construction expenditures were $4,401,750. Comparative figures follow:

	1914	1913
Gross earnings	$6,495,814	$5,546,587
Expenses	3,674,706	3,222,226
Net earnings	$2,821,108	$2,324,361
Interest paid and accrued	882,313	695,702
Surplus after interest	$1,938,795	$1,628,659

Ottumwa Railway & Light Statement.—Earnings for the year ended Dec. 31, 1914, of the Ottumwa (Ia.) Railway & Light Company, which is operated by H. M. Byllesby & Company, follow:

	1914	1913
Gross earnings and miscellaneous income	$324,928	$320,684
Expenses and taxes	179,126	175,172
Net earnings	$145,802	$145,512
Interest charges	66,918	66,786
Surplus	$78,884	$78,726
Preferred stock dividends	31,493	31,493
Balance	$47,391	$47,233

Mackay Companies Annual Report.—The Mackay Companies, according to the annual report, has issued no bonds, notes or stock nor incurred any debts during the past eight years. The profit and loss account for the year ended Feb. 1, 1915, is as follows:

Receipts:		
Income from investments in other companies		$4,246,014
Disbursements:		
Dividends paid on the Mackay Companies' preferred shares	$2,000,000	
Dividends paid on the Mackay Companies' common shares	2,069,020	
Operating expense	60,584	
Total		4,129,604
Balance carried forward		$116,410

Tonawanda Power Statement.—The operating statement of the Tonawanda Power Company for the year ended Dec. 31, 1914, is as follows:

	1914	1913
Gross earnings	$233,209	$224,175
Operating expenses	194,558	191,917
Net earnings	$38,651	$32,258
Other income	1,270	1,449
Net income	$39,921	$33,707
Deduct:		
Interest	$9,000	$9,000
Taxes	11,432	11,147
Insurance	3,322	1,653
Fixed charges, etc.	$23,754	$21,800
Surplus income for the year	$16,167	$11,907

Noblesville Heat, Light & Power Annual Report.—The ninth annual report of the Noblesville (Ind.) Heat, Light & Power Company for the year ended Dec. 31, 1914, states that in the past two years the company has added 118 customers on the "rural contract plan," whereby the customer pays $50 to the company on the expenses of the main line, which amount is later refunded to him in energy. The amount received from rural customers for energy during the year was $936. The total rural connected load amounted to 198 hp, an increase of 117 hp over the previous year. The comparative earnings reports for the years ended Dec. 31, 1913 and 1914, follow:

	1914	1913
Gross earnings	$83,453	$70,889
Operating expenses and taxes	55,032	42,202
Net earnings	$28,421	$28,687
Dividends from securities	27	27
Gross income	$28,448	$28,714
Interest on bonds and floating debt	8,000	8,084
Income, less interest	$20,448	$20,630
Depreciation	7,500	7,500
Net income	$12,948	$13,130
Dividends	4,000	2,000
Surplus for year	$8,948	$11,130

Columbus Consolidation Authorized.—Authority has been granted for the consolidation of the Columbus Light, Heat & Power Company with the Columbus Railway, Power & Light Company on the basis approved by stockholders of both companies recently. The company may now complete its reorganization and put into operation its plans for increasing operating efficiency and economy, as well as a new basis for financing. Plans for financing were announced some time ago, but under present depressed conditions they will not be carried out now. These plans include the sale of new securities for refunding underlying bonds of the different companies which entered into the consolidation and for improvements and extensions. The reorganization has reduced the aggregate capital stock $2,000,000, but otherwise there has been little change in the financial arrangements.

Westinghouse Earnings.—The income account of the Westinghouse Electric & Manufacturing Company and American subsidiaries for the nine months ended Dec. 31, 1914, as reported to the New York Stock Exchange is as follows:

Gross earnings:		
Sales billed		$26,278,076
Cost of sales		24,627,925
Net manufacturing profit		$1,650,151
Other income:		
Interest and discount	$304,270	
Dividends and interest on sundry stocks and bonds owned	444,190	
Miscellaneous—royalties, etc.	15,739	
		764,199
Gross income from all sources		$2,414,350
Deductions from income:		
Interest on bonds	$767,950	
Interest on collateral notes	166,866	
Interest on long-term notes and mortgages	37,785	
Portion of expenses incidental to bond and note issues	72,708	
Miscellaneous	14,875	
		1,060,184
Net income available for dividend and other purposes		$1,354,166
Profits and loss credits:		
Profit and loss surplus, March 31, 1914	$7,659,130	
Miscellaneous	82,578	
		7,741,708
Gross surplus		$9,095,874
Profit and loss charges:		
Dividends on preferred capital stock	$209,932	
Dividends on common capital stock	1,054,582	
Loss on sales of sundry investments (net)	34,991	
Premium on 6 per cent collateral notes	64,756	
Miscellaneous	144,495	
		1,508,756
Surplus, Dec. 31, 1914, per balance sheet		$7,587,118

Manufacturing and Industrial

The Inland Electric Company, 14 North Franklin Street, Chicago, Ill., has recently taken over the Steelite Company.

The Trio Manufacturing Company, Rock Island, Ill., has appointed the American Manufacturers' Agency, Inc., Chicago, Ill., its agent.

The Beacon Miniature Electric Company, 108 Duane Street, New York, has opened a branch office at San Francisco, Cal., where it will keep on hand a complete stock of its products. Some of the material will be manufactured in San Francisco.

L. O. Duclos, for fifteen years sales manager of the Massachusetts Chemical Company, is about to enter into business for himself with headquarters in Boston. Mr. Duclos will place on the market various kinds of insulating varnishes and friction tape.

The Kerr Turbine Company, Wellsville, N. Y., has appointed Mr. W. E. Storey, formerly with the Underfeed Stoker Company and the Goulds Manufacturing Company, as its representative in Toronto, Canada. Mr. Storey's office will be in the Kent Building.

Landers, Frary & Clark.—Mr. E. W. Donaho, formerly Chicago salesman for the Hotpoint Electric Heating Company in Chicago, has accepted a position with Landers, Frary & Clark, New Britain, Conn., and will handle the electrical appliance trade of the latter firm in the Chicago territory.

Simplex Wire & Cable Company.—Mr. Henry A. Moss, vice-president and electrical engineer of the Simplex Wire & Cable Company, Boston, Mass., will give an illustrated lecture on the manufacture of rubber-covered wire and cable before the Wolverine Automobile Club, Detroit, on Saturday, Feb. 20.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has moved the offices of its newly organized automobile equipment department from East Pittsburgh to Shadyside Station, Pittsburgh, where they will be in the works devoted exclusively to the manufacture of Westinghouse automobile equipments. This department was organized on Jan. 1, with Mr. G. B. Griffin as manager, and takes the place of that formerly known as the automobile equipment division of the detail and supply department.

The Westinghouse company reports that the business in automobile equipments has been very satisfactory, thus making it desirable to concentrate the sales and works departments at one point. In addition to the new headquarters, service stations have been established in New York, Chicago, Indianapolis, Cleveland and Detroit.

Diehl Manufacturing Company.—Mr. C. A. S. Howlett, who has been appointed vice-president in charge of sales of the Diehl Manufacturing Company, Elizabeth, N. J., was for four years connected with the sales department of the General Electric Company at Schenectady, N. Y., following his departure in 1909 from Chicago, where he had been well known as a member of the organization of the Western Electric Company. Mr. Howlett was twice elected president of the Chicago Electric Club, and upon resigning that office when he left Chicago he was made a life member of the organization.

Guy Anchor for Transcontinental Telephone Line.—According to Mr. L. E. Sperry, Pacific Coast representative of W. N. Matthews & Brother, of St. Louis, the Western Electric Company recently ordered a number of cuts of "Matthews" No. 800 anchors to fill an order from the Pacific Telephone & Telegraph Company. These anchors were required for use on the San Francisco to New York line, which passes through a portion of Nevada that is low and ordinarily dry in summer but where, owing to heavy rainfalls in the winter of 1913-1914, the water did not evaporate last summer. When the line was built through this lowland the ground was soft, and this winter, on account of storms and heavy rains, it became necessary to hold up the poles on this part of the line with guy anchors.

New Motors for Flashers Proving Successful.—The Reynolds Electric Company, 422 South Talman Avenue, Chicago, Ill., has recently developed alternating-current motors with ratings of 1/20 hp, 1/12 hp, 1/8 hp and 1/6 hp, which are designed particularly for the operation of flashers. A number of these motors will be used at the Panama-Pacific Exposition for the operation of both flashers and motion-picture apparatus. The United States government has ordered several of the machines, which will be employed to operate some of its educational displays at the Exposition. The manufacturers also declare that the motors are well adapted for driving washing machines and other types of apparatus operated by fractional-horse-power machines.

Lamp Manufacturers' Activities in California.—Mr. H. H. Cudmore, of the lamp bureau of the General Electric Company, who has been actively engaged in the exploitation of the company's tungsten lamps in San Francisco and central California territory during the past six months, recently declared, after a trip to the home office of the company, that the activities of the bureau will be extended to Los Angeles and the surrounding territory. A branch office will be opened at 124 West Fourth Street, Los Angeles, with Mr. F. J. Blaschke in charge. The bureau will also encourage co-operative work among distributers of lamps bearing the trade-mark. The bureau will be assisted by Mr. C. Baker, who is assistant to Mr. J. A. Vandegrift, manager of the Oakland Lamp Division for the National Lamp Works of the General Electric Company, and representatives of the Edison Lamp Works of the General Electric Company from the San Francisco and Los Angeles offices.

The Standard Underground Cable Company, Pittsburgh, Pa., has appointed Mr. A. B. Saurman, for the past seven years Pacific Coast manager, as Southeastern manager, with headquarters in Philadelphia. Mr. Saurman will succeed the late C. E. Hughes. Mr. Saurman became associated with the above company in Philadelphia in 1893 and after two and one-half years in its construction department was transferred to its Eastern sales department with headquarters at New York City. In 1900 he was made manager of its Northeastern sales department with headquarters at Boston. In 1902 he was transferred to San Francisco to take charge of the company's interests on the Pacific Coast. Mr. Saurman has been connected with the Standard Underground Cable Company for more than twenty-one years. Mr. John P. Bell, who will succeed Mr. Saurman as Pacific Coast manager of the company, entered its employ at Pittsburgh, Pa., in 1896. For the past eight years Mr. Bell has been assistant secretary and treasurer of the company.

Mr. H. H. Engle, who recently resigned his position as Chicago sales engineer for the Electric Controller & Manufacturing Company of Cleveland, Ohio, has for the last seven years been engaged in the application and sale of motors and electrical control equipment for machine tools. A native of Terre Haute, Ind., Mr. Engle was graduated from Rose Polytechnic Institute in 1901, and after completing his engineering course he was employed by the Terre Haute (Ind.) Traction Company, the St. Louis (Mo.) Traction Company, the Metropolitan Street Railway Company of New York City, the Baldwin Locomotive Works at Philadelphia, the Hicks Locomotive & Car Works at Chicago, Stevens & Tyler, consulting and contracting engineers of Chicago, the Reliance Electric & Engineering Company at Chicago, and the Electric Controller Manufacturing Company at Chicago. While at the head of the Chicago office of the Reliance Electric & Engineering Company Mr. Engle was in direct charge of the sale and installation of individual-motor-drive and electric-control apparatus to replace group and belt drives in the large shops of the Chicago (Ill.) Railways Company and the Detroit (Mich.) United Railway Company.

Westinghouse Electric & Manufacturing Company.—Mr. William P. Cochran, formerly head of the industrial and power department of the Baltimore office of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been appointed branch manager of the Baltimore office, which has been consolidated with the Philadelphia office of the company. Mr. H. H. Seabrook, formerly manager of the Baltimore office, is now manager of the consolidated territory with headquarters at Philadelphia. Mr. Cochran was graduated from Pennsylvania State College in 1898 with the degree of bachelor of science in electrical engineering. Upon leaving college he was appointed electrical assistant to the president of the Martic Water & Power Company at Wrightsville, Pa., which company later developed into the Pennsylvania Water & Power Company and is now supplying electrical energy to the cities of Baltimore, Md., and Lancaster, Pa. This position Mr. Cochran retained until 1899. He then entered the testing department of the General Electric Company in New York, where he was employed during 1899 and 1900. In 1901 he entered the employ of the Webster Coal & Coke Company, for which he was electrical engineer. From 1902 to 1904 Mr. Cochran was mechanical and electrical engineer and assistant general superintendent of the Lackawanna Coal & Coke Company, succeeding from this position to that of master mechanic for the Pittsburgh-Buffalo Coal Company at Cannonsburg, Pa., in 1905. In the fall of this year Mr. Cochran entered the employ of the Westinghouse Electric & Manufacturing Company, being stationed at Charleston, W. Va., where he remained until the fall of 1910, at which time he left the company and became general manager and treasurer of the Kanawha Fire Engine Company. After two years he returned to the employ of the Westinghouse company and was assigned to the Baltimore office as manager of the industrial and power division.

NEW YORK METAL MARKET PRICES

	Feb. 9 Selling Prices Bid	Feb. 9 Selling Prices Asked	Feb. 16 Selling Prices Bid	Feb. 16 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot*	62 10 0		63 15 0	
Prime Lake	14.50 to 14.75		14.62½ to 14.87½	
Electrolytic	14.50 to 14.60		14.55 to 14.65	
Casting	14.00 to 14.25		14.10 to 14.20	
Copper wire base	15.75 to 15.87½		..... to 15.87½	
Lead	3.80		3.85	
Nickel	40.00 to 45.00		40.00 to 45.00	
Sheet zinc, f.o.b. smelter	11.50		12.00	
Spelter, spot	..... to 8.00†		9.00 to 9.25†	
Straits tin	36.12½		36.37½	
Aluminum, 98 to 99 per cent	19.00 to 19.50		19.00 to 19.50	

*OLD METALS

Heavy copper and wire	12.50	12.50
Bras, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	3.60	3.60
Zinc, scrap	5.37½	5.37½

COPPER EXPORTS

Exports of copper in form of pigs, ingots, bars, plates and scrap for week ended Feb. 6, 1915.....9,714,979 lb.

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Lovell Light & Power Company, of Fryeburg, Maine, has been chartered with a capital stock of $5,000. Charles E. Fox is president, and Nelson T. Fox is treasurer and clerk, both of Lovell.

The Cobden Light & Power Company, of Cobden, Ill., has been incorporated with a capital stock of $5,000 to construct and operate an electric-light plant. The incorporators are I. H. Lawrence, R. H. Lawrence and R. L. Lawrence.

The Mutual Electric Company, of Middleport, Ohio, has been organized with a capital stock of $10,000 for the purpose of constructing and operating an electric distributing plant. Electricity will be secured from the Floodwood plant. O. E. Harrison and others are interested in the company.

New Industrial Companies

The Crown Chandelier Company, of New York, N. Y., has been incorporated with a capital stock of $15,000 to manufacture and deal in lighting fixtures. The incorporators are A. Brodner, David S. Pine and Sidney M. Israel, 103 Mott Street, New York, N. Y.

The Standard Electric Novelty Company, of Chicago, Ill., has been incorporated by Albert R. Dittman, Walter A. Rollert and Arthur A. Schneider. The company is capitalized at $25,000 and proposes to manufacture and deal in flashlights, cases, batteries, etc.

The Industrial Chemicals, of Portland, Maine, has been incorporated with a capital stock of $200,000 to manufacture and deal in chemical, electrical and physical products, including calcium carbide, calcium cyanamide, etc. The officers are A. F. Jones, president, and T. L. Croteau, treasurer, both of Portland.

The Luthy Electric Manufacturing Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $350,000 for the purpose of manufacturing electrical batteries and electrical and mechanical apparatus. The incorporators are Y. Hicks, J. O. Luthy and C. M. Dickson, of San Antonio, Tex.

The American Electro-Cide Company has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $300,000, for the purpose of manufacturing a machine for the killing of insects harmful to plant life. The incorporators are M. W. Sparks, of Washington, D. C.; F. L. Mettler and Alfred Whartenby, of Wilmington, Del.

Trade Publications

Electric Hand-Lamp.—The Bass-Moody Company, Peoria, Ill., is sending out a circular describing its No. 6 battery lantern, which is called the "step-o-lite."

Electric Hand-Lamp.—The Delta Electric Company, Marion, Ind., has issued a folder which describes and illustrates its No. 7 hand-lamp and other lighting devices.

Insulating Joints and Hickeys.—The Trumbull Electric Manufacturing Company, Plainville, Conn., has prepared a folder entitled "Circle T Insulating Joints and Hickeys."

Turbine Blowers.—Bulletin No. 27, published by the L. J. Wing Manufacturing Company, 352 West Thirteenth Street, New York, describes the company's type E turbine blowers.

Illuminometer.—"The Macbeth Illuminometer" is the subject of an illustrated catalog recently issued by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa.

Battery-Charging Device.—A vibrating type of battery charger is the subject of a catalog being sent out by the St. Louis Electrical Works, 5410 Eastern Avenue, St. Louis, Mo.

Pole-Line Hardware.—The St. Louis Malleable Casting Company, St. Louis, Mo., has recently issued a catalog which describes over 2200 devices for pole and transmission lines.

Circuit-Breakers.—The Automatic Reclosing Circuit Breaker Company, Columbus, Ohio, is sending out a booklet which describes its circuit-breakers for direct-current circuits.

Street-Lighting Fixtures.—The George Cutter Company, South Bend, Ind., has issued Catalog No. 13, illustrating and describing various types of street and industrial lighting fixtures.

Electric Lantern and Candle.—The Baker-Smith Company, Rialto Building, San Francisco, Cal., is sending out leaflets which describe and illustrate its electrically operated lantern and candle.

Therapeutic Lamps.—The X-Radio Thermo Lamp Company, 1328 Broadway, New York, has recently issued several folders which describe and illustrate its lamp designed for curative purposes.

Lighting Unit.—The Dale Lighting Fixture Company, 107 West Thirteenth Street, New York, has issued a catalog which describes a convertible unit for indirect, semi-indirect and direct lighting.

Steel-Covered Extension Cord.—The Inland Electric Company, 14 North Franklin Street, Chicago, Ill., is sending out a leaflet which describes its new covered extension cord which is called "steelite."

Portable Electrical Tool.—The United Manufacturing Company, Kansas City, Mo., has issued a folder which describes its variable-speed electrically operated tool for drilling, buffing, polishing, etc.

Rice Leaders of the World Association.—An attractive cloth-covered booklet entitled "On Business Integrity," by Elwood E. Rice, enumerates some of the activities of the Rice Leaders of the World Association.

Multi-Port Valves.—The Harrison Safety Boiler Works, Philadelphia, Pa., has issued Catalog No. 601, which describes and illustrates a number of multi-port valves designed for back-pressure, release and vacuum service.

Wiring Devices.—The Crouse-Hinds Electric Company, Syracuse, N. Y., has issued Bulletin No. 1000-B, which describes a number of devices called "condulets." This bulletin is a supplement to the company's Catalog No. 1000.

Water Purifying and Softening Systems.—Wm. B. Scaife & Sons Company, 221 First Avenue, Pittsburgh, Pa., have issued a booklet entitled "Central Power Station Economy," referring to its We-Fu-Go water softening and purifying equipment.

Wiring Devices.—Fish-wire outlet boxes for concrete work, conduit bushing adapters and hickey fixture hangers are described in Bulletins No. 25, No. 26, No. 27 and No. 28 issued by the Steel City Electric Company, 1207 Columbus Avenue, Pittsburgh, Pa.

Electric Bells.—The P R Manufacturing Company, 621 Bellevue Avenue, Detroit, Mich., is sending out mailing cards designated as No. 1, No. 2, No. 3 and No. 4 and a folder, which contain information on a recently developed electrically operated bell.

Electric-Sign Lighting.—The Thomas Cusack Company, Chicago, Ill., is sending out a bulletin entitled "Engineering Features of Electric-Sign Lighting." This bulletin is a reprint of a catalog published by the National Lamp Works of the General Electric Company.

Convertible Lighting Fixture.—The Dale Lighting Fixture Company, 107 West Thirteenth Street, New York, has just issue a catalog entitled "Lighting Commercial Buildings," which describes its "Broadway" convertible unit for direct, indirect and semi-indirect lighting.

Electrically Operated Fans.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is sending out circulars entitled "The Cool Home," "The Cool Theater," "The Cool Restaurant," "The Cool Hotel," "The Cool Office" and the "Cool Store," and each circular describes special fans for the service desired.

Data on Aluminum Products.—The British Aluminum Company, London, England, the Canadian head office of which is at 60 West Front Street, Toronto, has issued a cloth-bound loose-leaf handbook which contains much valuable information on aluminum alloys and on bars, strips, billets, cables, connectors, sheets, tubes, etc., of aluminum. The handbook is illustrated with numerous diagrams.

Construction News

New England

SALEM, N. H.—The Salem Lt., Ht. & Pwr. Co. has entered into an agreement with the Haverhill El. Co., of Haverhill, whereby the former will secure energy to operate the local system from the Haverhill company. A transmission line will be erected from Haverhill and connection made with the local lines. The steam plant will be discarded and the water-power plant at North Salem will be retained for use in case of emergency.

BRIDGEPORT, CONN.—The United Illg. Co., of Bridgeport, is building a new power house and adding a number of large boilers, together with coal and ash-handling apparatus and steam turbine. All equipment and material has been purchased. Charles A. Paul is manager.

Middle Atlantic

ANGOLA, N. Y.—The Niagara & Lake Erie Pwr. Corpn., Marine National Bank Building, Buffalo, has applied to the Public Service Commission for permission to construct an electric distributing system in Angola and for approval of exercise of a franchise from the village.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until March 1, for electric work for Brooklyn Vocational School (top of Cary Building), corner of Nassau and Jay Streets, borough of Brooklyn. Bids will also be received at the same time and place for installing electric equipment in the addition to and alterations in Public School 36, on Stagg and Ten Eyck Streets, between Bushwick Avenue and Waterbury Street, borough of Brooklyn. Blank forms, plans and specifications may be seen or obtained at the above office and at branch office, 131 Livingston Street, Brooklyn.

DUNKIRK, N. Y.—Preparations are being made by the Dunkirk Electrical Mfg. Co. for the installation of two return tubular boilers of about 500 hp with some type of high-efficiency furnaces. Specifications have been prepared for the boilers, but the type of furnace has not yet been decided upon. H. T. Litchfield is secretary.

MASSENA, N. Y.—The St. Lawrence Transmission Co., of Massena, has applied to the Public Service Commission for permission to erect electric transmission lines and approval of franchises in St. Lawrence County.

NEW YORK, N. Y.—Bids will be received by the board of trustees of Bellevue and Allied Hospitals Department of New York City, Bellevue Hospital, 415 East Twenty-sixth Street, New York, N. Y., until Feb. 24 for furnishing labor and material for reconstruction of the existing branch circuits of the electric-lighting systems, and furnishing, installing and connecting additional gas piping; also furnishing and installing and connecting gas and electric fixtures for the main building of the Harlem Hospital, 136th and 137th Streets and Lenox Avenue, borough of Manhattan. Blank forms and further information may be obtained at the office of the contract clerk and auditor, 400 East Twenty-ninth Street, New York.

PLEASANT VALLEY, N. Y.—In response to the request of prominent residents of Pleasant Valley the Central Hudson Gas & El. Co., of Poughkeepsie, is preparing estimates of cost of supplying that section with electricity. The cost of erecting a transmission line to Pleasant Valley and equipping 40 street lamps is estimated at about $10,000.

ROME, N. Y.—Bids will be received by Charles R. Mahady, president of board of managers, New York State Custodial Asylum, Rome, N. Y., until March 1, for construction of dormitory building, including heating, plumbing and electrical work. Drawings and specifications may be seen at the New York State Custodial Asylum, Rome; at the Department of Architecture, Room 1224, Woolworth Building, New York, and at the Department of Architecture, Capitol, Albany. Lewis F. Picher is state architect.

WELLSBURG, N. Y.—The Elmira Transmission Corpn. has applied to the Public Service Commission for permission to erect an electric distributing system in the village of Wellsburg and for approval of the exercise of a franchise received from the village.

WEST WINFIELD, N. Y.—Application has been made to the Public Service Commission by Charles G. Senif and Louis B. Senif (as partners) for permission to construct an electric-lighting plant in the village of West Winfield, and for approval of franchise from the Village Trustees.

ALLENTOWN, PA.—The Trayor Engineering & Mfg. Co., of Allentown, which is erecting a large addition to its plant, has contracted with the Lehigh Valley Lt. & Pwr. Co. for electricity for lamps and motors to the amount of 500 hp. The service will be taken in 25-hp motors. The Traylor company is planning to abandon its 80-hp power plant.

BETHLEHEM, PA. — The Borough Council has adopted the recommendation of the light committee for the extension of the boulevard lighting system. The first extension will be the installation of standards on Main Street between Market and Church Streets.

CATASAUQUA, PA.—The Lehigh Valley Lt. & Pwr. Co., of Allentown, has closed a contract with the Bryden Horse-Shoe Co., of Catasauqua, for energy to operate its plant.

GARRETT, PA.—The property of the Garrett El. Lt., Ht. & Pwr. Co. has been purchased by the Meyersdale Lt., Ht. & Pwr. Co., of Meyersdale.

GLEN RIDDLE, PA.—A permit has been granted the estate of Daniel Lee to construct a concrete power house in Glen Riddle.

PITTSBURGH, PA.—Bids will be received at the office of the city controller, Municipal Hall, Pittsburgh, until Feb. 26 for supplying electricity to be used in such buildings and such places as the city may require within the city of Pittsburgh for a period of three years; also for the supply of energy (alternating current) at the city's North Side electric generating plant at Brocket Street, North Side, Pittsburgh, for a period of five years.

PITTSBURGH, PA.—The extension of the ornamental street-lighting system, which includes Sixth Avenue from Liberty Avenue to Grant Street, Smithfield Street from Liberty Avenue to Fifth Avenue and Wood Street and from Liberty Avenue to Fifth Avenue, has been placed in operation. It is the intention of Director Swan to continue the ornamental lighting system in Smithfield Street from Fifth Avenue to the Pittsburgh and Lake Depot, Wood Street from Fifth to Water Street, Federal Street from Liberty Avenue to the North Side, and Penn Avenue from Stanwix Street across the new Point Bridge to the North Side. These extensions will be made as soon as possible.

SCHUYLKILL HAVEN, PA.—Improvements will be made to the municipal electric-lighting plant, including the installation of a new switchboard, in the near future.

SCRANTON, PA.—Plans have been completed by the Scranton & Binghamton R. R. Co. for the construction of a large power plant at Dalton to supply all the energy needed for the railway.

NEWARK, N. J.—The Board of Public Works has authorized the installation of new flaming-arc lamps on Broad Street, between Central and Belleville Avenues. The lamps will be installed by the Public Ser. El. Co.

NEWARK, N. J.—Bids will be received by the Board of Freeholders until Feb. 24 for the installation of an electric passenger elevator at the new tuberculosis hospital at Cedar Grove. Specifications may be seen at the office of John F. Capen, architect, 207 Market Street, Newark.

NEW BRUNSWICK, N. J.—The Board of Freeholders has authorized the advertising for bids for electrical fixtures for the remodeled court house, the cost not to exceed $2,500.

WOODBINE, N. J.—The Woodbine Land & Improvement Co. expects to change its system from direct current to alternating current in the near future, so as to furnish electricity to light the state roads and nearby towns. W. E. Bertrand is superintendent of power.

WILMINGTON, DEL.—Specifications are being prepared for lighting the streets of the city with electricity, for which bids will soon be asked. The present contract with the Wilmington & Philadelphia Trac. Co. expires April 1.

ELKINS, W. VA.—The Elkins Pwr. Co., which is now using natural gas for fuel, expects to put in coal equipment this summer as a substitute for gas, possibly using stokers; will need coal-handling devices or conveyors. The company also contemplates installing a 500-kva turbine-driven generator. C. C. Bosworth is superintendent.

WHEELING, W. VA.—The West Virginia Trac. & El. Co., of Wheeling, is reported to be contemplating removing its station in Leatherwood, which is situated near the bridge across Waddell's Run, to the opposite side of the stream.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 23, for furnishing at the various navy yards and naval stations supplies as follows: Newport, R. I., Schedule 7896—1-ton trolley hoist; Schedule 7898—2000 lb. copper tubing. Bids will be received until Feb. 27 for miscellaneous hydroaeroplanes, complete, and power plants, to be delivered at Pensacola, Fla., as per Schedule 7895. Bids will also be received at the same place until March 2 for the following: Washington, D. C., Schedule 7914—10,100 rubber gaskets, Norfolk, Va., Schedule 7926—2500 ft. steel tubing and miscellaneous steel-boiler tubing. Brooklyn, N. Y., Schedule 7925—4000 ft. interior communication cable, 3000 searchlight carbons, 20 combination oil and electric signal lights and 10,000 ft. twin-conductor wire. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 15,515—An American consular officer in Switzerland reports by telegraph that a firm in his district, which has branch offices in Italy and Belgium, is desirous of communicating with American manufacturers of engineers' supplies and technical specialties, such as power transmission, driving belts, lubricating apparatus, oil filters, water, steam pipes and refrigerator insulations, and ventilators and fans. No. 15,485—A merchant in Russia informs an American consul that he wishes to be placed in communication with manufacturers of steam turbines and steam engines. Correspondence may be in English. No. 15,571—An American consular officer in Norway reports that a firm in his district is inviting bids for the construction of an electric mountain railway. When plans and specifications arrive they may be examined at the Bureau of Foreign and Domestic Commerce and its branch offices. No. 15,561—An important firm in Russia has informed an American consul that it wishes to represent American manufacturers of hardware, tools, electric lamps and electrical fixtures, etc. No. 15,582—A firm in Europe has informed an American consular officer that it wishes to import electrical goods, especially motors for driving machinery, etc. Correspondence, catalogs, etc., should be in Spanish. No. 15,591—The Bureau of Foreign and Domestic Commerce is in receipt of a letter from a business man in Spain stating that he wishes to represent American manufacturers of or dealers in copper, latten and aluminum wire and plates, etc. No. 15,593—A general commission agent in Europe has informed an American consular officer that he wishes to import glassware, wire and steel products. Catalogs and correspondence should be in Spanish. No. 15,574—The Secretary of Commerce is in receipt of a communication from a business man in Spain stating that he wishes to establish commercial relations with American firms manufacturing and exporting lamps, electric-lighting apparatus and toys. No. 15,580—A business man in southern Europe has informed an American consul that he wishes to import automobiles, autotrucks and lighting fixtures. Correspondence and catalogs should be in Spanish. Further information may be obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branches.

North Central

CADILLAC, MICH.—The Merchants' Association is contemplating the installation of an ornamental street-lighting system in the business district. The present plans provide for 93 lamp standards mounted with a single 200-cp nitrogen-filled lamp, maintained with underground wires, to cost approximately $7,000. Contracts have not yet been placed. J. M. Bothwell is chairman of lighting committee.

CHARLOTTE, MICH.—The City Council is contemplating the installation of an ornamental street-lighting system in the business district.

GRAND BLANC, MICH.—Arrangements are being made to install an electric lighting system in Grand Blanc.

HIGHLAND PARK, MICH.—Plans are being considered for the installation of an ornamental street-lighting system in the business district.

LAPEER, MICH.—Plans are being considered for installing an ornamental lighting system in the business district, to cost about $3,000. Ornamental standards car-

rying five-lamp clusters are under consideration.

STURGIS, MICH.—The Board of Public Works expects to install about 50 additional ornamental "novalux" unit lamps, erected on crushed concrete standards, this year. J. S. Flanders is manager.

BEACH CITY, OHIO.—The Gilmore Lt. & Pwr. Co. expects to erect a transmission line to Wilmot and Mount Eaton in the spring. Next fall the company expects to install a frequency changer to change the system from 25 cycles to 60 cycles. W. D. Gilmore is superintendent.

BUTLER, OHIO.—Preparations are being made by the Board of Public Affairs for the installation of two 50-hp or one 100-hp gas engine in the municipal electric-light plant to replace the 90-hp steam engine and boiler. The engine and boiler will be for sale. H. M. Swank is clerk of board.

CLEVELAND, OHIO.—Plans have been submitted by the Corrigan-McKinley Co., of Cleveland, to P. J. Phillips, city plan examiner, for a new power house as an addition to the plant of the River Furnace & Dock Co. The cost of the building is estimated at $125,000.

CLEVELAND, OHIO.—Bids will be received by the commissioner of purchases and supplies, No. 511 City Hall, Cleveland, until Feb. 26, for transformers for the Municipal Electric Light Department. Specifications may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street, Cleveland.

CLEVELAND, OHIO.—Bids will be received by the commissioner of purchases and supplies, No. 511 City Hall, Cleveland, until Feb. 26 for double-braided, rubber-covered wire for the Municipal Electric Light Department. Specifications may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, No. 511 City Hall, Cleveland, until Feb. 26 for a high-pressure duplex boiler-feed pump for the Municipal Electric Light Department. Specifications may be obtained at the office of the commissioner of the light and heat division, 1443 East Third Street.

COLUMBUS, OHIO.—The Columbus Ry., Lt. & Pwr. Co. has closed a contract with Wallick Brothers, lessees of the new Deshler Hotel building, to supply electricity for the hotel for a period of 25 years.

GALION, OHIO.—The Galion Iron Wks. & Mfg. Co. has recently awarded a contract, through the Bruce-Macbeth Engine Co. of Cleveland, for equipment for a small-size power plant, consisting of one 150-hp four-cylinder, vertical-type gas engine directly connected to a 125-kva Burke generator, to be installed in a new building which will be erected by the Galion company. The building willl be 26 ft. by 40 ft. and provision will be made for the installation of additional units as required. D. C. Boyd is president and general manager of the Galion company.

MANTUA, OHIO.—The Mantua Lt., Ht. & Pwr. Co. has submitted a proposal to the Village Council offering to sell the electric-light plant to the village.

MARION, OHIO.—The Marion Ry., Lt. & Pwr. Co. will erect 18 five-lamp clusters on Main Street. Property owners will pay the cost of the installation of the system and the city will pay for maintenance of the lamps.

SOUTH SOLON, OHIO.—The Washington Gas & El. Co., of Washington C. H., is contemplating extending its transmission lines to South Solon to supply electricity here. The proposed street-lighting system will require 60 lamps of 60 cp.

WASHINGTON C. H., OHIO.—The installation of a new street-lighting system is under consideration by the City Council. The Washington Gas & El. Co. has the contract for lighting the streets, and it is proposed to install a more modern system at the expiration of the present contract.

YOUNGSTOWN, OHIO.—The lighting committee of the Council has directed the city solicitor to draw up a resolution authorizing the service director to enter into a contract with the Youngstown & Sharon Street Ry. Co. for street-lighting service.

CLAY, KY.—The Clay Lt. & Ice Co. is contemplating the installation of a laundry in connection with its plant and would like to correspond with manufacturers of laundry machinery. C. R. Clark is secretary.

HOPKINSVILLE, KY.—The City Council has passed an ordinance providing that wires shall be placed underground on the principal streets of the city.

IRVINE, KY.—A franchise has been granted to H. E. Hay, of Corbin, to construct and operate an electric-lighting plant in Irvine. Under the terms of the franchise work must begin on the plant within six months.

LOUISVILLE, KY.—The Board of Park Commissioners has awarded a contract to the Louisville Gas & El. Co. for the erection of 250 electric lamp standards mounted with 100-watt nitrogen lamps in the city parks and along the parkways. These lamps will replace 217 gasoline lamps which are now in use. The new lamps will be maintained by underground wires.

NEW HAVEN, KY.—The town authorities have obtained an option on the mill property owned by B. D. Florence & Son, which they propose to utilize for a power house for the electric-light plant.

AUBURN, IND.—The city of Auburn is contemplating the installation of an ornamental lighting system. E. Wineland is superintendent.

KNOX, IND.—The Knox El. Lt. & Pwr. Co. expects to install a three-phase alternating-current generator during the coming summer. Thomas A. Grist is owner and manager.

LOOGOOTEE, IND.—The Loogootee El. Lt., Pwr. & Wtr. Co. is contemplating the erection of two 8-mile transmission lines and establishing a 24-hour service. Jesse Rutledge is manager.

MUNCIE, IND.—Next summer the Muncie El. Lt. Co. expects to erect 8 miles of 35,000-volt transmission lines, connecting its substation at Dunkirk with the town of Albany, Ind.; also to purchase within the next three months equipment and materials for the above line, including poles, copper wire, hardware, etc. W. O. Haymond is construction superintendent.

DIXON, ILL.—The Dixon Cereal & Feed Co. is contemplating the installation of a 75-hp to 100-hp engine, burning kerosene or cheaper oil. For details see proposal columns.

HILLSBORO, ILL.—The Southern Illinois Lt. & Pwr. Co., of Hillsboro, expects to erect within the next ten months a 33,000-volt transmission line from Collinsville to O'Fallon, Ill.; water tower at O'Fallon; substations at Collinsville, O'Fallon and Carbon; 33,000-volt transmission line from Hillsboro to Gillespie, with substation at Gillespie; also to purchase within the next three months two 286-hp boilers and two K type Green stokers to be installed at its power plant, Hillsboro, Ill.; one 300-hp boiler and one Green stoker to be installed at plant in Collinsville. Within the next six months the company expects to make improvements to its distribution and street-lighting systems in O'Fallon and Hillsboro. Electrical appliances and supplies will be purchased as needed.

JACKSONVILLE, ILL.—Property owners along Sandy Street are contemplating the installation of ornamental lamps.

LENA, ILL.—Within the next six months the Lena El. Lt. & Pwr. Co. expects to purchase one 150-hp L. H. Corliss engine (flywheel 10 in. in diameter; would prefer a second-hand machine); would consider an automatic engine if in good condition. G. W. Benfer is president.

RANKIN, ILL.—The Rankin El. Lt. Co. will erect a transmission line to East Lynn (4 miles long, 2300 volts, single-phase) early in the spring; will also install a generator (from 60 kw to 75 kw) and engine, and establish a day service. Charles J. Cramp is owner and manager.

STOCKTON, ILL.—Within the next three months the Stockton El. Co. expects to install a series incandescent-lighting system. H. A. Smith is president.

KAUKAUNA, WIS.—The Municipal Electric and Water Department will soon take over and operate a new 300-hp hydroelectric plant in Kaukauna. Auxiliary power will be purchased from the Wisconsin Public Service Co., of Green Bay. W. B. Montgomery is manager.

MELLEN, WIS.—The Mellen Wtr. & Lt. Co. will change its system from 133 cycles to 60 cycles in about a month. A. W. Pribnow is president and manager.

WAUSAUKEE, WIS.—The proposal to secure electrical service from the High Falls plant is under consideration. The cost of the project is estimated at about $10,000.

WESTBY, WIS.—The Light Commission is contemplating changing the system of the municipal electric-light plant from direct-current to alternating current. Earl D. Slach is superintendent.

WYOCENA, WIS.—The Board of Supervisors of Columbia County has appropriated $15,000 for construction and equipment of a central heat, light and power plant for the group of county buildings at Wyocena. An appropriation of $30,000 had previously been made for the construction of a new almshouse. Portage is the county seat.

MILAN, MINN.—Plans are being prepared by Houghland & Kanton for the installation of an electric-light and power plant in Milan.

SPRING VALLEY, MINN.—The Southern Minnesota Pwr. Co., of Spring Valley, expects to purchase within the next six months one 72-in. by 18-ft. boiler; also to purchase within the next two months 80 series street-lighting fixtures and to install a complete new street-lighting system in Spring Valley and erect 24 miles of three-phase, 13,200-volt transmission lines, and also to install a new street lighting system in Stewartville, Minn. The company has recently built a new coal shed of 600 tons capacity and erected a transmission line from Spring Valley to Wykoff, a distance of 7 miles. W. R. Rutledge is secretary.

CONRAD, IA.—The contract for lighting the streets of the village has been awarded to the Iowa River Lt. & Pwr. Co., of Eldora.

GRUNDY CENTER, IA.—The Grundy Center El. Co. is contemplating extending its transmission lines to Holland and Wellsburg, a distance of about 10 miles, to furnish electricity for lamps and motors in both towns. The plans provide for an outdoor substation in both places. The equipment of the Wellsburg station will consist of two 15-kva, 6600/220/110-volt transformers; Holland, two 10-kva, 6600/220/110-volt transformers: Grundy Center, two 20-kva step-up transformers, 1100/2200/6600-volt. Ten miles of three-wire No. 6 semi-hard-drawn copper wire will be required for the transmission line. Arrangements have not yet been completed for the project. J. B. Calderwood is owner and manager.

ALTAMONT, MO.—The town of Altamont is reported to be negotiating with the officials of the town of Gallatin for electrical service from the municipal electric-light plant in that place.

CARTHAGE, MO.—Within the next two months the Board of Public Works expects to purchase one 40-hp or 50-hp, 60-cycle, two-phase, 220-volt induction motor, and also a deep-well pump capable of delivering about 220 gal. per minute and two 20-kw transformers. A. P. Knowles is superintendent.

DEEPWATER, MO.—Work will begin within the next 30 days on the construction of the proposed municipal electric-lighting plant. J. P. Davis, of Windsor, Mo., is engineer in charge of the work.

ELSBERRY, MO.—Within the next 30 days the city of Elsberry expects to purchase one 25-kw alternating-current generator and engine directly connected (second-hand and in good condition). W. B. Ellis is secretary.

FAIR PLAY, MO.—The local electric-light plant, owned by Akins Brothers, has been purchased by J. W. Lowery, of Dunnegan, who will complete the new plant. The citizens have voted to extend the lighting service to all parts of the town. For the last two months the town has been without street-lighting service.

HALE, MO.—Preparations are being made for the installation of a municipal electric-lighting plant, the equipment to consist of one 50-hp and one 40-hp oil engine, one 35-kw and one 25-kw generator, one three-panel switchboard and about 50 kw in transformers. The present plans provide for 50 100-watt tungsten lamps for street lighting. Contracts for equipment have not yet been awarded. W. B. Rollins & Co., Midland Building, Kansas City, Mo., are engineers in charge.

KANSAS CITY, MO.—The contract for electrical fixtures and wiring for the new Central High School has been awarded to the R. W. Hodge El. Co., of Kansas City, at $5,871.

KANSAS CITY, MO.—The directors of St. Joseph Hospital have engaged Henrici, Kent & Lowry, Reserve Bank Building, Kansas City, as engineers in connection with the construction of power plant for hospital.

SPRINGFIELD, MO.—Contracts, it is reported, will soon be awarded for equipping the Houston & Liggitt Pencil Factory for electrical operation. Twelve motors using about 100 hp will be purchased. At present the factory is operated by steam power.

TROY, MO.—The managers of the municipal electric-light plant expect to cut all poles off and reset line this spring. D. A. Presley is manager.

HUNTER, N. D.—The Hunter Lt. & Pwr. Co. is contemplating the installation of a larger oil engine and generator in the spring. F. C. Hockbridge is vice-president.

BONESTEEL, S. D.—The installation of an electric-lighting system in Bonesteel is reported to be under consideration.

SUMMIT, S. D.—At an election held recently the proposal to install an electric-light plant in Summit was carried.

NORTH BEND, NEB.—The contract for the construction of the new electric-light-

ing plant in North Bend has been awarded to Herman Rennau & Co., of North Bend, at $18,995, the work to be completed by May 1. Energy for operating the local system will be obtained from Fremont.

CHAPMAN, KAN.—The City Council has decided to call an election soon to submit the proposal to issue bonds for the construction of a municipal electric-lighting plant to the voters.

CONCORDIA, KAN.—The Concordia El. Lt. Co., it is reported, has purchased the property of the Clyde El. Lt. Co. of Clyde, and proposes to erect a transmission line from Concordia to that town to supply electrical service there. Later on the line will probably be extended to other towns.

IOLA, KAN.—Within the next few weeks the municipal electric-lighting system will be changed from single-phase to three-phase and the output of the plant more than doubled. The present equipment will be sold and one 425-kva Allis-Chalmers belted alternator and one 500-kva Allis-Chalmers generator directly connected to a cross-compound condensing Corliss engine of the same make will be purchased. The voltage will not be changed. The present arc-lighting system will be replaced with nitrogen-filled incandescent lamps. T. R. Bartlett is general superintendent.

KANSAS CITY, KAN.—Bids will be received in duplicate by the Kaw Valley Drainage District of Wyandotte County, at its office, 719 Osage Avenue, Kansas City, Kan., until Feb. 27, for furnishing a hydraulic dredge and necessary equipment for the improvement of the Kansas River at Kansas City. Bids are to be submitted for a 15-in. and 18-in. dredge delivered at Kansas City, to be operated by either steam or electricity. T. E. Myers is president.

McCUNE, KAN.—Bonds to the amount of $25,000 have been voted for the installation of a water-works system to be operated in connection with the municipal electric-light plant. The pumping will be done by a motor-driven pump. G. E. Mason is engineer of power station.

PRATT, KAN.—Plans, it is reported, are being prepared by E. T. Archer & Co., New England Building, consulting engineers, Kansas City, Mo., for extensions to the electric-lighting system.

Southern States

LA GRANGE, N. C.—The City Council is contemplating issuing bonds to the amount of $50,000 for the construction of an electric-lighting plant, water-works systems and street paving.

WALTERBORO, S. C.—The H. S. Jaudon Engineering Co., Savannah, Ga., has been engaged by the City Council to prepare plans and supervise the construction of the municipal electric-lighting plant, for which bonds to the amount of $15,000 have been voted.

RICHLAND, GA.—At an election to be held March 24 the proposal to issue $20,000 in bonds, the proceeds to be used to extend the lighting and water systems, will be submitted to the voters.

OCALA, FLA.—The city of Ocala expects at once to purchase a motor to drive pumps for water-works system and also motor-driven air compressors. J. C. Caldwell is superintendent.

PIEDMONT, ALA.—Plans are being considered to establish a day service for motors, and also for the installation of a new boiler and generator. J. P. Hastam, Jr., is manager.

GULFPORT, MISS.—Within the next 30 days the Gulfport & Mississippi Coast & Trac. Co., of Gulfport, expects to purchase six quadruple equipments for cars. W. F. Gorenflo is manager.

JACKSON, MISS.—The proposal to issue $160,000 in bonds for the construction of a municipal electric-light and power plant will be submitted to the voters on March 13.

NEW ORLEANS, LA.—Plans are being considered by Ohio capitalists, represented by M. Bishop, of Cleveland, Ohio, it is reported, for the construction of a municipal electric-lighting plant for the city of New Orleans.

BENNINGTON, OKLA.—The property of the Bennington Lt., Ice & Pwr. Co. has been purchased by John D. Bomford, who, it is said, will make improvements to plant and may later install an ice factory.

CUSTER CITY, OKLA.—An election will be held March 4 to submit the proposal to issue $10,000 in bonds for the purpose of installing a 10-ton ice plant in connection with the electric-light and water plant to the voters. H. H. Hatchet is superintendent.

YALE, OKLA.—Bonds to the amount of $22,000 have been voted for the installation of a municipal electric-lighting plant and extensions to the water-works system.

DALLAS, TEX.—The Dallas Southwestern Trac. Co., of Dallas, it is reported, will soon begin work on the construction of its proposed electric railway between Dallas and Cleburne. Necessary franchises and other preliminary arrangements have been made. The company is also making investigations with a view of constructing an interurban electric railway between Cleburne and Ballinger, a distance of 175 miles. B. S. Wathen is consulting engineer and E. P. Turner is president.

DENTON, TEX.—At an election held recently the proposal to issue $10,000 in bonds for improvements and extensions to the municipal electric-lighting plant and water-works system was carried.

YOAKUM, TEX.—The City Council has contracted with the Yoakum Pwr., Lt. & Wtr. Co. for lighting the streets of the city. The contract provides for the installation of 15 lamps of 400 cp and 28 lamps of 100 cp.

Pacific States

ALBION, WASH.—The City Council has appointed a committee, consisting of Charles Huff, P. H. Matson, C. E. Clavert, Eugene Rice and C. E. Wright, to investigate the cost and feasibility of installing a municipal electric-lighting plant in Albion.

ELLENSBURG, WASH.—Improvements are contemplated to the municipal electric-light plant involving an expenditure of about $65,000. The installation of steam equipment capable of developing 1300 hp is under consideration; also construction of a new concrete forebay.

MONTESANO, WASH.—The Northwest El. & Wtr. Wks., of Montesano, has awarded the contract for equipment of its new electric plant in Montesano to the Lamb Machine Co., of Hoquiam. The equipment includes generators, switchboards, motors, etc. The plant will have a generating capacity of 400 kw.

RICHFIELD, WASH.—The contract for the installation of an electric transmission system, consisting of poles, overhead wires, street lamps, transformers and motors, has been awarded to Ne Page, McKenna & Co., Armour Building, Seattle.

ADIN, CAL.—The Adin El. Co. has turned its electric plant over to the city, to be owned and operated by the municipality.

FRESNO, CAL.—The contract for the installation of the new electrolier system has been awarded to the Woodhill-Hulse El. Co., of Los Angeles, Cal., at $36,973. Cast-iron standards will be used.

LA GRANGE, CAL.—The Yosemite Pwr. Co., of La Grange, has acquired the property, reservoir sites, water rights, etc., of the National Park El. Co., located on the Middle and South forks of the Tuolumne River. The Yosemite company, it is understood, will soon begin work on extensions to its system.

LAKEPORT, CAL.—During the coming year the Mount Konocti Lt. & Pwr. Co., of Lakeport, expects to erect about 15 miles of transmission lines and may possibly increase the output of its substation and raise the voltage to 11,000. A. C. Hastings is vice-president.

PHOENIX, ARIZ.—A proposal to supply electricity to farmers northeast of Phoenix is being promoted by the Falls Pwr. & El. Co. About $45,000, it is understood, has been subscribed toward the project. The directors of the company are John Munson, H. Leppac, W. B. Twitchell, W. S. Perry, A. G. Bailey, C. M. Etter and T. T. Powers.

HELENA, MONT.—Within the next 30 days the Helena Lt. & Ry. Co. expects to purchase 3 miles of No. 4 weather-proof, triple-braided wire and a 100-hp motor with meter. C. A. Bernier is superintendent of electrical department.

EATON, COL.—The Farmers' El. & Pwr. Co,, of Eaton, is extending its transmission lines to supply electricity for irrigation pumping plants and feed-cutting plants; total extension aggregating about 25 miles. C. H. Williams is manager.

Canada

HUNTSVILLE, ONT.—The Town Council is contemplating extensions to the municipal electric-light system, to cost about $4,000. G. Ralston is manager.

ST. MARY'S, ONT.—On March 1 the municipal electric-light system will be changed to 25 cycles. All 60-cycle apparatus will be discarded. Steam engines and boilers will be kept in reserve for emergencies. A synchronous motor will be used to supply electricity in case of failure of hydroelectric power. The steam pump will be discarded and a gasoline-driven centrifugal pump installed. H. M. Miller is manager.

Miscellaneous

CORDOVA, ALASKA.—Harry H. Knox, president and manager of the Alaska El. Consol Co., which has a franchise to install and operate an electric-light and power plant in Cordova, states that work on the proposed plant will begin early in the spring.

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until March 3, for furnishing electric cable, terminal bells, plow steel, flexible cable, expansion reamers, etc. Blanks and general information pertaining to the circular (No. 901) may be obtained at the above office. Major F. C. Boggs is general purchasing officer.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEBRUARY 9, 1915.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,127,383. ELECTRICAL FIXTURES AND THEIR ATTACHMENT TO CONDUITS; C. W. Abbott, Auburn, N. Y., and H. R. Gilson, Baden, Pa. App. filed May 6, 1913. Combination of fixtures with metallic conduit.

1,127,405. TELEPHONE SYSTEM; E. H. Clark, Austin, Ill. App. filed July 3, 1912. Economy of live conductors.

1,127,408. ELECTRIC SWITCH; R. C. Cole, Hartford, Conn. App. filed March 17, 1913. Quick-acting push-button service switch.

1,127,414. DYNAMO-ELECTRIC MACHINE; W. W. Dean, Elyria, Ohio. App. filed Nov. 21, 1910. Ignition magneto with readily accessible make-and-break contacts.

1,127,424. THERMOPILE; P. Ferra, Lyons, France. App. filed June 10, 1912. Has a packing of sulphur, kaolin and copper sulphide.

1,127,425. ELECTRIC WELDING MACHINE; S. B. Field, Holbrook, Mass. App. filed March 20, 1914. Automatically produces a sequence of welding spots.

1,127,427. CONTROLLING MECHANISM FOR ELECTRIC AUTOMOBILES; O. P. Fritchle, Denver, Col. App. filed Sept. 2, 1913. Prevents accidental starting or reversing.

1,127,436. DYNAMIC RETURN INDICATION SIGNAL; W. S. Henry, Rochester, N. Y. App. filed June 22, 1911. For semi-automatic signal used in connection with a mechanical interlocking machine.

1,127,437. UNIVERSAL CORD CIRCUIT; J. E. Hilbish, La Grange, Ill. App. filed April 11, 1914. Means for automatically adjusting the supervisory apparatus to conform to magneto or common-battery control.

1,127,438. RAILWAY SIGNALING; J. S. Holliday, Wilkinsburg, Pa. App. filed July 26, 1913. Alternating-current track-circuit apparatus.

1,127,442. ELECTRICAL SWITCH; B. D. Horton, Detroit, Mich. App. filed Nov. 25, 1913. Ironclad type with means for accelerating the action of the operating crank.

1,127,453. DEVICE FOR AUTOMATICALLY LOWERING THE TROLLEY POLE OF ELECTRICALLY DRIVEN VEHICLES; C. Ködderitzsch, Dortmund, Germany. App. filed Oct. 11, 1913. Mechanical features of construction.

1,127,464. ELECTRIC REGENERATIVE MOTOR AND SYSTEM OF CONTROL; R. Lundell, New York, N. Y. App. filed March 13, 1911. Series-parallel control of separately excited motors.

1,127,466. SELECTIVE CONTROLLING APPARATUS; F. R. McBerty, New Rochelle, N. Y. App. filed Sept. 2, 1909. For predetermining and "counting" the number of current impulses to be transmitted.

1,127,467. TELEPHONE-EXCHANGE SYSTEM; F. R. McBerty, New Rochelle, N. Y. App. filed Nov. 8, 1911. Automatic switching apparatus.

1,127,470. ELECTRIC RAILWAY; C. B. and J. F. McLeer, Brooklyn, N. Y. App. filed July 27, 1912. Novel mounting for the movable motor element on the car which co-operates with the fixed motor element along the right-of-way.

1,127,474. INSULATOR SUPPORT; G. Mardock, Illinois City, Ill. App. filed Feb. 16, 1914. Cross-arm and insulator-base construction.

1,127,475. ELECTRIC FURNACE; J. G. Marshall, Niagara Falls, N. Y. App. filed April 9, 1913. Has independent heating units or "foci."

1,127,499. ELECTRODE; C. E. Osmer and J. B. Roach, Beardstown, Ill. App. filed March 9, 1914. Special construction for locomotive headlamps.

1,127,513. PAPER CONDENSER; A. Pruessman, Chicago, Ill. App. filed Aug. 2, 1913. Rolled condenser in sealed container.

1,127,526. ELECTRIC HEATER; G. J. Schneider, Detroit, Mich. App. filed Nov. 10, 1911. Has a detachable heating unit.

1,127,527. LIGHTING FIXTURE; A. Schoen, Chicago, Ill. App. filed March 7, 1914. Semi-indirect.

1,127,554. THERAPEUTIC ELECTRIC APPARATUS; R. H. Wappler, New York, N. Y. App. filed Aug. 21, 1913. For applying alternating current or direct current, or both, to patient's body.

1,127,558. CARBON HOLDER; W. W. Wile, Bluffton, Ind. App. filed May 1, 1914. Special clamp construction.

1,127,563. DYNAMO-ELECTRIC MACHINE; G. Winter, Vienna, Austria-Hungary, and F. Eichberg, Berlin, Germany. App. filed June 11, 1902. Alternating-current commutation-type machine.

1,127,564. DYNAMO-ELECTRIC MACHINE; G. Winter, Vienna, Austria-Hungary, and F. Eichberg, Berlin, Germany. App. filed June 11, 1902. Special magnetizing windings.

1,127,573. MULTIPLE SWITCH CONTROLLER; P. H. Zimmer, Milwaukee, Wis. App. filed March 10, 1913. Successively operating switches.

1,127,578. ARC-LAMP ELECTRODE; A. T. Baldwin, Lakewood, Ohio. App. filed May 22, 1913. Fused oxides of cerium, zirconium and tungsten.

1,127,593. RAILWAY-TRAFFIC-CONTROLLING APPARATUS; J. P. Coleman, Edgewood Borough, Pa. App. filed July 22, 1914. Indication apparatus for the switches of railway crossovers.

1,127,618. INDICATOR; A. R. Hartmann, Houston, Tex. App. filed Sept. 18, 1913. For giving signal and sounding alarm when vehicle reaches certain speeds.

1,127,631. SWITCH; S. N. Jordan, Lowell, Mass. App. filed March 23, 1914. For elevator motors of the induction type.

1,127,655. ELECTRIC FLASHER FOR MULTIPLE SETS OF LAMPS; E. C. Lorenz, San Francisco, Cal. App. filed March 23, 1914. Arched thermostat structure.

1,127,665. ELECTRIC NEEDLE; G. H. Murphy, Redding, Cal. App. filed May 21, 1914. Has a detachable point.

1,127,696. LIGHTNING-ROD LOW TOP; J. S. Swenson, Cresco, Ia. App. filed Jan. 10, 1914. Has integral braces by which it is secured in place and connected to lightning-rod cable.

1,127,716. CAR TRUCK; W. S. Adams, Philadelphia, Pa. App. filed March 11, 1914. Combination of coil and elliptic springs.

1,127,730. DIRECTION INDICATOR FOR VEHICLES; T. W. Byrne, Los Angeles, Cal. App. filed March 15, 1913. Curved solenoid swings the semaphore arm.

1,127,738. TUNING DEVICE FOR WIRELESS-TELEGRAPH SYSTEMS; A. J. Coughenour, Fort Leavenworth, Kan. App. filed Jan. 24, 1914. Variable inductance coil and switch therefor.

1,127,741. PROCESS FOR MAKING TERMINAL BANKS; A. F. Dixon, Newark, N. J. App. filed Feb. 26, 1912. For selector switches.

1,127,761. ELECTRIC SIGNALING APPARATUS AND CIRCUITS; F. B. Herzog (deceased), New York, N. Y. App. filed Aug. 15, 1890. Novel form of annunciator and receiver.

1,127,776. INSULATOR; C. W. Kettron, Macomb, Ill. App. filed April 4, 1912. Of divided block construction.

1,127,779. ELECTRIC SWITCH; C. J. Klein, Milwaukee, Wis. App. filed Jan. 28, 1914. Double push-button snap switch.

1,127,805. IGNITION TIMER FOR GAS ENGINES; J. T. Pedersen, Flushing, N. Y. App. filed Feb. 4, 1914. Terminal and contact structural features.

1,127,808. SEQUENCE SWITCH; J. N. Reynolds and C. F. Baldwin, Greenwich, Conn. App. filed March 1, 1913. Large number of circuit changes with a minimum amount of apparatus.

1,127,827. IGNITION SYSTEM; B. P. Swyers, Pittsburgh, Pa. App. filed Jan. 19, 1914. High-tension and low-tension circuits controlled by combination lock can be operated independently or simultaneously.

1,127,839. PORTABLE BATTERY LIGHT; L. A. Williamson, New York, N. Y. App. filed May 26, 1913. Electric-lamp receptacle removably secured to battery binding posts and provided with a switch.

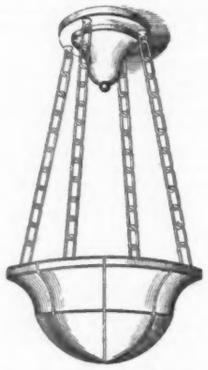
1,127,855. TELEGRAPH KEY; J. N. Bell, Oneida, N. Y. App. filed Oct. 20, 1913. Predetermined number of dots transmitted by one stroke of the key.

1,127,856. POCKET LAMP; O. A. Boehm, New York, N. Y. App. filed April 16, 1914. Lamp bulb is secured to inner side of lid and emits light through hole in lid.

1,127,864. TROLLEY SWITCH; W. R. Daggert, Seattle, Wash. App. filed June 16, 1913. For keeping trolley wheel on proper trolley wire.

1,127,876. SELECTIVE SIGNALING SYSTEM; J. C. Field, Orange, N. J. App. filed Aug. 23, 1912. All of the lines emanating from a common station may be operated from common current source without interference.

1,127,885. RAIL CONNECTION; P. Hamill, Jerome, Pa. App. filed July 19, 1912. Fishplate has recesses in it receiving and protecting the rail bond.



1,127,527—Lighting Fixture.

1,127,889. TELEPHONE-EXCHANGE APPARATUS; E. E. Hinrichsen, Alexander, Ill. App. filed Nov. 30, 1910. Prevents central-station operator from ringing on a substation line while the substation telephone is in use.

1,127,897. METHOD OF THERAPEUTIC TREATMENT AND APPARATUS THEREFOR; J. H. Kellog, Battle Creek, Mich. App. filed May 18, 1912. Administering radium emanations and use of air or oxygen.

1,127,903. COMBINED ELECTRIC INCANDESCENT LAMP AND REFLECTOR; C. P. Lawson, Brockton, N. Y. App. filed March 10, 1914. Central filament support serves as a reflector.

1,127,916. BURGLAR ALARM; T. H. Nelson, Chicago, Ill. App. filed Feb. 28, 1913. Means to prevent actuation of signal when authorized person goes through the door.

1,127,921. APPARATUS FOR RADIO COMMUNICATION; G. W. Pickard, Amesbury, Mass. App. filed Nov. 9, 1908. Tuning inductance of the "fixed winding type."

1,127,935. TERMINAL CONNECTION; A. H. Snyder, Lancaster, N. Y. App. filed Aug. 15, 1912. For storage batteries, corrodible parts being protected from corrosive vapors or liquids.

1,127,936. STORAGE-BATTERY CELL; A. H. Snyder, Lancaster, N. Y. App. filed Aug. 15, 1912. Sealing and unsealing of the covers for the battery jars.

1,127,966. DEPOSITION OF IRON; S. O. Cowper-Coles, Westminster, London, Eng. App. filed Aug. 1, 1914. Iron sponge added to the electrolyte and electrolyte is agitated to neutralize the acid.

1,127,973. HANDLE SWITCH; J. Elia, Chicago, Ill. App. filed Nov. 13, 1911. For metal finishing or buffing machines.

1,127,996. ELECTRIC SWITCH; P. V. Hunter, Newcastle-Upon-Tyne, England. App. filed May 6, 1913. Arcs forming at break are in parallel, arc-extinguishing proximity.

1,128,005. ADJUSTABLE SPEED CONTROL FOR ELECTRIC MOTORS; A. Kimble, Oak Park, and J. D. Nies, St. Charles, Ill. App. filed Oct. 10, 1913. Governor-controlled means regulates voltage supplied motor.

1,138,008. ALTERNATING-CURRENT INDICATOR; C. Krämer and J. Krell, Frankfort-on-the-Main, Germany. App. filed July 12, 1909. For transmitting orders, indicating positions of a rudder, etc.

1,128,013. SIGNALING-INSTRUMENT SET; M. Levison, Chicago, Ill. App. filed May 27, 1912. For hospitals, etc.; factory-assembled and ready for attachment to the live wires.

1,128,019. TELEPHONE CALL RECORDER; D. J. McGauran, Geraldton, Western Australia, Australia. App. filed May 21, 1914. Penalizes subscriber for not answering call within predetermined time.

1,128,036. ELECTRIC IMPLEMENT; L. Paulero, Petersburg, Va. App. filed Aug. 29, 1912. For stone-cutting, riveting, etc.

1,128,057. BLOCK-SIGNAL SYSTEM FOR ELECTRIC RAILWAYS; F. W. Sawyer, Boston, Mass. App. filed July 20, 1903. Rails cross-bonded.

1,128,066. SIGNAL FOR AUTOMOBILES AND OTHER VEHICLES; E. C. Shuler and S. Cohen, Dover, N. J. App. filed Oct. 11, 1913. Readily attachable foot-operated signal for warning of intended movements of vehicles.

1,128,070. VAPOR-ELECTRIC DEVICE; R. G. Standerwick, Lynn, Mass. App. filed Oct. 4, 1913. For preventing overheating of quartz lamps.

1,128,075. SIGNALING SYSTEM; J. B. Struble, Wilkinsburg, Pa. App. filed Feb. 13, 1903. Track transformers and relays controlled thereby.

1,128,081. ELECTRIC-HEATING DEVICE; F. M. Vogel, Pittsfield, Mass. App. filed June 15, 1912. For matrix drying.

1,128,102. ELECTRICALLY HEATED SOLDERING IRON; L. W. Campbell, South Yarra, Victoria, Australia. App. filed Jan. 7, 1914. Utilizes all heat and the lead wires are protected against short-circuiting.

1,128,106. ELECTRICAL CONDUIT ATTACHMENT; L. H. Church, Stamford, Conn., and A. McMurtrie, New York, N. Y. App. filed April 15, 1911. Connection for armored cable with outlet box.

1,128,116. METALLIC ELECTRIC WELDER; W. H. Dralle, Schenectady, N. Y. App. filed July 25, 1914. Arc vaporizes the electrode and causes the metal to be deposited on the joint.

1,128,126. SIGNAL SYSTEM; G. Furrer, Oakland, Cal. App. filed April 21, 1914. For burglar and fire alarms.

1,128,141. ELECTRIC FIRE ALARM; W. E. Howells, Peckville, Pa. App. filed Jan. 7, 1914. Thermostat and contact mechanism.

1,128,163. AUTOMATIC ELECTRIC-HEATING SYSTEM; J. F. McElroy, Albany, N. Y. App. filed Feb. 27, 1912. Pneumatically operated heater switch.

1,128,167. CIRCUIT CONTROLLER; E. Manson, Sagamore, Mass. App. filed April 1, 1914. Flashlamp secured to umbrella handle.

1,128,210. SIGNALING SYSTEM; G. Witty, Scranton, Pa. App. filed Jan. 10, 1913. Wireless system for trains and ships.

1,128,229. METHOD AND APPARATUS FOR GENERATING ELECTRICITY; D. F. Comstock, Brookline, Mass. App. filed Nov. 10, 1911. Direct from heat.

1,128,232. STORAGE-BATTERY-SEPARATOR CONSTRUCTION; J. N. Davis, Denver, Col. App. filed Feb. 16, 1914. Envelop separating and inclosing the battery plates.

1,128,250. SIGNAL APPARATUS FOR AUTO-VEHICLES; C. C. Holmes, Pasadena, Cal. App. filed March 24, 1914. Swinging signal arm supported on bonnet of auto.

1,128,261. LIGHTNING-ROD HIGH TOP; J. S. Swenson, Cresco, Ia. App. filed Jan. 10, 1914. Connecting and bracing means for bracing and maintaining close joint with conductor.

1,128,262. TELEPHONE SYSTEM; H. S. Turner, San Diego, Cal. App. filed June 20, 1914. Dispenses with need for the "Number, please" query. (One hundred and five claims.)

1,128,270. DYNAMO-ELECTRIC GENERATOR; G. and L. Inrig, London, Eng. App. filed July 20, 1912. Car-axle-driven; generates in either direction.

1,128,275. STORAGE BATTERY; A. H. Snyder, Lancaster, N. Y. App. filed Aug. 15, 1912. Sealed, for submarine use

13,878 (reissue). CURRENT GENERATOR AND IGNITER FOR INTERNAL-COMBUSTION ENGINES; E. Podlesak, Tiffin, Ohio. App. filed Dec. 23, 1914. (Original patent No. 1,055,076, dated March 4, 1913.) Make-and-break type; reciprocating actuator.